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EDITED BY

G. STANLEY HALL
JOHN WALLACE BAIRD
L. R. GEISSLER

And a Board of Co-operating Editors

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The Journal of Applied Psychology

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(d) The psychology of everyday activities, such as reading, writing, speaking, singing, playing games or musical instruments, sports, and the like.

In reply to several inquiries the editors wish to state that those mental tests which aim to deal with purely educational problems or abnormal minds do not as a rule fall within the scope of the JOURNAL.

Each issue of the JOURNAL will contain about one hundred pages; the subscription price will be $4.00 per annum, or $1.25 per copy. Payments of subscription, advertisements, reprints, etc., should be remitted to Miss Florence Chandler, Publisher, Clark University, Worcester, Mass.

The JOURNAL is privately financed by the editors; and until it becomes self-supporting they request that co-operating editors and contributors shall accept and support the following terms:

Contributors will be expected to pay the costs of cuts, and the excess cost involved in the setting of tabular matter. If contributors re-write their contributions when proof-sheets are submitted to them, they will be expected to pay the printer's bill for re-setting, the editors agreeing to pay costs amounting to five per cent. of the original cost of composition. Three copies of the JOURNAL will be furnished to each contributor; reprints will be supplied at cost. As soon as the JOURNAL becomes self-supporting, or as soon as the present excessive prices of paper and printing abate, the above terms will be made more liberal.

To Co-operating Editors. It is hoped that every co-operating editor will contribute reviews or summaries of books and articles; they will receive free copies of the JOURNAL, at least during the first year.

To Contributors of Original Articles. Since the JOURNAL aims primarily to cover the field of practical applications of psychology, the editors suggest that articles should not exceed ten printed pages (about forty-five hundred words); the extreme limit is twenty pages. It is suggested that technical descriptions of apparatus and methods be avoided, that tables and cuts be used sparingly, and that emphasis be laid upon clear and accurate statement of results, together with their practical applications.

To Publishers. The editors request that books and monographs dealing with topics which lie within the field of the JOURNAL be sent for review. Such books sent us will be at least mentioned by title, and the more important of them will receive extended reviews. Copies of the JOURNAL, or clippings containing reviews or notices, will be forwarded to publishers from whom books have been received.

To Reviewers of Books. The editors suggest that reviewers should adopt the following procedure: First present a brief, concise and sympathetic epitome of the essential content of the book under review, employing the author's language so far as possible, and stating his chief conclusions with the greatest fidelity possible; then in a second paragraph the reviewer may add his own comment or criticism. The type of alleged review which consists in a series of running comments upon the general topic in question, without any systematic endeavor to present the author's position, will not be welcomed by the JOURNAL.

A limited number of exchanges with other journals in allied departments will be accepted; and the list of exchanges will be revised from time to time.

Communications and Mss. may be sent to any one of the three editors; reviews, summaries, notices, books and articles for review should be addressed to Dr. L. R. Geissler, Clark University, Worcester, Mass.

FOREWORD

The past few years have witnessed an unprecedented interest in the extension of the application of psychology to various fields of human activity. Teachers and administrators of educational affairs were among the first to realize that the findings of the psychologist may be of value in the solving of practical problems; and the voluminous and growing literature of educational psychology testifies to a widespread belief that psychology is a valuable asset to the educator. Within the past decade one finds increasing evidence, in various quarters, of an equally widespread but more recent conviction that a knowledge of psychology is no less serviceable in the practice of medicine, in the administration of justice, and in various other pursuits. And attempts are now being made to apply the principles of psychology to the solving of problems in such widely divergent disciplines as history, religion, sociology, art, politics, and language.

But perhaps the most strikingly original endeavor to utilize the methods and the results of psychological investigation has been in the realm of business. This movement began with the psychology of advertising,—where at a relatively early date investigators attacked the analytic problem of determining what psychological factors are concerned in the 'appeal of the advertisement,' and the practical problem of utilizing and controlling these factors more judiciously and effectively,—but it soon spread to the adjacent field of salesmanship. The endeavor to discover what mental qualities contribute to success in salesmanship has gradually led to an attempt to analyze mental equipment into fundamental qualities or traits, and to discover the significance of each of these qualities as factors in determining successful achievement. Thence the attention of the applied psychologist turned to the more comprehensive and fundamental problem of vocational selection,—the question, namely, of making a detailed inventory of the equipment of mental qualities possessed by a given individual, of discovering what qualities are essential to successful achievement in a given vocation, and thus of directing the individual to the vocational niche which he is best fitted to fill.

The growing impetus of this movement may be observed in various quarters; and the workers in this field are clamoring for more effective methods of diagnosing character and intellectual equipment. These clamors are either wholly unheeded by the psychologist, or are but partially and inadequately satisfied. Yet the problem which is here concerned is one which must appeal to the interest of every psychologist who besides being a 'pure scientist' also cherishes the hope that in addition to throwing light upon the theoretical problems of his science, his findings may also contribute their quota to the sum-total of human happiness; and it must appeal to every human being who is interested in increasing human efficiency and human happiness by the more direct method of decreasing the number of cases where a square peg is condemned to a life of fruitless endeavor to fit itself comfortably into a round hole. The problem, therefore, is one which touches the psychologist not only as a scientist but in his relations to his fellowmen and to the practical concerns of life; and it is equally of interest to various groups of non-psychological workers,—employers of skilled labor, employees, sociologists, criminologists, moralists, legislators, administrators of justice and many others. The problem is so far-reaching that one finds it difficult to determine whether the burden of its significance attaches to its psychological, its economic, or its social aspects. The psychologist finds that the old distinction between pure and applied science is already obscured in his domain; and he is beginning to realize that applied psychology can no longer be relegated to a distinctly inferior plane.

There already exist a number of journals and a number of associations which have been established to serve the interests of psychology. But none of the existing journals devote themselves to the task of gathering together the results of workers in the various fields of applied psychology, or of bringing these results into relation with pure psychology. And while the programs of the psychological conventions are largely occupied with the discussion of practical problems, the reports of these discussions appear only in the technical journals and scarcely ever reach those laymen who are most interested in these questions.

In view of all of these circumstances the undersigned have decided, not without hesitation, to launch a Journal of Applied Psychology,—their hesitation being of financial origin because they have no pecuniary resources in hand or in prospect, excepting their own. They hope that the JOURNAL OF APPLIED PSYCHOLOGY (a) may bring together the now widely scattered data in this and other countries; (b) may gather from the various industries and from other practical fields data which shall be of real value for pure psychology; (c) may indicate new applications of psychology to the arts and to the occupations of human life, to which psychologists have hitherto made but little contribution.

G. STANLEY HALL.
JOHN WALLACE BAIRD.
L. R. GEISSLER.

PRACTICAL RELATIONS BETWEEN PSYCHOLOGY AND THE WAR[1]

G. STANLEY HALL

Rash as it may seem to draw any lesson as yet from the present war, in which the great Nordic race which embraces the dominant elements in all the belligerent nations is committing suicide, the following points, which can be only hinted at in my twenty minutes, seem to me worthy of consideration here.

Mr. Hafner, through whom most of us receive our foreign periodicals, writes, "About one thousand French and German scientific publications have suspended as a result of the war, and about half of those that remain have been issued less frequently or in reduced size." They have also suffered in quality because so many collaborators doing the best work have been sent to the front, and many of them wounded or killed. About all the research being now carried on is in the medical field and in hospitals. Since April last practically all continental publications have been kept out of this country. This affects not only our journal clubs but cuts us off from the stimulus of European thought, so that we are now the only great country in the world where research can go on as before.

Last month I asked and obtained the responses of representative authorities of all the twenty-four universities in the American Association concerning this situation. The responses were very diverse. One prominent university president amplified the view that it was high time and would do good for America to be weaned from its European alma mater. Another held that the cessation of importation of intellectual goods made in Europe would cause the culture level not only in academic departments but throughout the world to sink to a lower level. Most, however, held that this shortage will be a new and serious responsibility upon American scholars to make it good, that the present situation is a loud, clear call to independence, an opportunity for new leadership, that it should result in higher standards of originality and increased output of investigation, that the war opens opportunities to American universities as great as it has afforded to certain industries here, and that we should emulate the latter in devising new methods and in vastly enhancing our output. If we only have the vision the war will bring here a great advance in culture. The new Research Council of the National Academy and the Committee of One Hundred, with their splendid if as yet unrealized program, indicate that we are at least making a feeble beginning to respond to the situation. A vast deal has been said and written about research here within the last eighteen months, and there is every prospect that it will have at least enough, let us hope not too much, organization.

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[1] Address prepared for the twenty-fifth anniversary of the American Psychological Association, New York, December, 1916.

As for psychology, whether we regard the quality or quantity of work done here in every field, all the way from introspection to behaviorism, including the study of animals, children, normal and subnormal, anthropology, especially as represented by our Bureau of Ethnology, the work in tests, scales, in standards, and indeed in about every domain of psychology (unless we except psychiatry, where most work worth while that has been done has been inspired either by Kraepelin or more lately by Freud), I believe we are quite ready to meet this call in the field of both pure and applied psychology, provided only we escape the obsession of finality in either method or result and realize that psychology is just beginning, the best things are yet to be found out, and that its difficulties and obscurities are the twilight of dawn and not that of evening.

2. Another effect of the war upon psychology that now seems probable is to lay new stress upon applied as distinct from pure aspects of research. For two and a half years, practically all the leaders in most of the physical sciences, particularly physics and chemistry, have ceased to advance their science as such and have been absorbed in making it immediately serviceable; while even in the most humanistic fields culture has yielded to *Kultur*. The criterion of values in science is now what it can do pragmatically, in the Vaihinger sense. Talent of the order of Edison or Burbank has taken precedence over that of men like Helmholtz and Weismann, and the work of the latter is transvalued by the test of utility. The war has given the world its greatest lesson in scientific efficiency. Just as Russia in the war with Japan did not begin to realize how far the latter country had moulted all its pre-Meji and indeed all liberal culture and focussed its entire energy upon practical efficiency, so none of the Entente Allies, least of all England, realized how far Germany had gone in

casting off the culture of half a century ago, and in almost a single generation acquiring a new soul that made it, instead of the least, the most hard-headed, practically effective nation the world has ever seen, with hardly a vestige of the old, speculative, sentimental traits of the days before 1870. As pure chemistry failed to appreciate the value of the formula for making nitrate, which Germany had secretly bought from its Norse discoverer, and which enabled it to produce three hundred thousand tons of ammunitions during the first year of the war, at one-third its cost to the Allies, so its tests of the sense, motility, fatigue; its establishment of distinct digestive, respiratory, muscular, and nervous types; its temibility tests, which eliminate from the ranks both on donning the uniform and after every wound, thereby greatly reducing liabilities to panic; the French tests and assignment of men to infantry, cavalry, artillery, aviation corps, etc., according to *the standard types of McAuliffe, Segaud, Thooris and* Sorel, have shown how immediately serviceable psychology could be made in a new field. Already enough of the carefully guarded military secrets of these tests for specific lines of military service have leaked out to suggest why the German and French armies are so much more effectively organized than the English and Russian, and to show that applied psychology can render the most valuable service. We see with mingled admiration and dismay to what lengths Germany will go in applying all the latest knowledge in every field, not only in industry, municipal social organization, and even in eugenics, in ways often far beyond the reaches of the old morality. Corporation schools, which here in the last four years have come to represent the advanced line of vocational discrimination and guidance, have already demanded of psychology vastly more knowledge of character and its traits than it has yet attained; and this has led, as we all know, to very many tables of human qualities, that are, some more, some less, scientific, and premature, so that we can only very imperfectly and tentatively answer all the questions that business is now putting to us. So the war has still more urgently called upon psychology to do things it was not ready for, which had to be done extemporarily and as best they could by intuition. In both fields the call is so loud and insistent that it seems to me every psychologist should be able to give some reason if he does not do what in him lies to a better knowledge of man and life under modern conditions, even if he has to break in some degree from his own lines of work, *in order to help in the supreme problem of diagnosing each individual,* and steering him toward his fittest place, which is really the culminating problem of efficiency, because human capacities are after all the chief national resources. In conning only a few of the some three thousand books and pamphlets on the war our library has made a specialty of collecting, only one topic has impressed me more than the literature that enumerates the various things which psychology is doing or can do, not only for war itself, but for the new social and industrial order which characterizes the state of a nation in war. Must we not, therefore, infer that such facts as these suggest that we read just the old differentiation between pure and applied psychology, and realize that research in the latter field may be just as scientific as in any other, and that the immediate utility of our results is at least no longer a brand of scientific inferiority?

3. We shall surely have a new and larger psychology of war. The older literature on it is already more or less obsolete from almost every point of view, and James' theory of a moral, and Cannon's of a physiological, equivalent of war seem now pallid and academic. More in point are the reversionary conceptions of Freud, Pfister and Patrick, that it is more or less normal for man at times to plunge back and down the evolutionary ladder, and to immerse himself in rank, primitive emotions and to break away from the complex conventions and routine of civilized life and revert to that of the troglodytes in the trenches, and to face the chance of instant death when the struggle for survival is at its maximum in the bayonet charge. Lahy, Crile and perhaps a score of others described, on the basis of much observation and insight, the stages of this recessional. First is the general perturbation at home when mobilization is decreed, the fraternization of all classes, normally more or less aloof; the rank credulities and superstitions that suddenly arise and spread by psychic contagion, often to the clearest heads and coolest hearts, on the basis of high expectant tension; the mad rumors, fears, suggestions, often so painfully acute that the call to arms is a relief.

Second comes the parting from home and loved ones; the donning of the uniform and with it the *esprit de corps* of the army; the intense activity of the training camp; the remarkable development of powers of effort and of endurance, which makes each often a marvel to himself, a power by which those from sedentary life often excel laborers and peasants; the games, songs, theatricals, often camp newspapers, in which phenomena we see instinct seeking to compensate, in Adler's sense, for a deeper but repressed anxiety. Life at this stage is so absorbing that the old life at home pales, and loved ones are thought of with surprising infrequency, and it becomes harder to write to them; the sudden setting up, physical and often moral, of flabby individuals, to sleeplessness, heat, cold and hunger, as the individual learns to draw upon his phyletic reserve, and is often surprised to find the largest drafts upon it honored.

Third, in the advance into the trenches, where silence and immobility are often necessary under the greatest excitement, breaking down many a nervous system, and when everything else, past and future, is forgotten in the struggle for present safety and physical comfort, the long confinement and constrained positions interspersed with digging, bailing water, with sometimes personal draftings to carry despatches or rescue wounded friends from the " hell-strip " between the most advanced opposing lines, the acute attention to the sound of projectiles and their explosion, it is no wonder that some grow mad and rush wildly at the enemy and to certain death, or else back to safety, while those with stronger nerves develop with amazing suddenness a callousness to danger, fatigue, hunger, discomforts, while we sometimes have the unique reaction of sudden fraternization with the enemy which Kreisler has so well described.

Fourth, when the charge is called, some drop, fatigued and perhaps dead from exhaustion, while others who thought themselves entirely spent marvel at the sudden development of utterly unexpected resources in their own systems. Here each faces his man intent only upon killing him and escaping from being killed himself. When this is all over the survivors frequently, and sometimes for days and weeks, live in an illusion that the charge is still on, and they cut, slash, stab imaginary enemies, while the same obsessions haunt their sleep, so that even the hospitals, a few days after the battle, are noisy with the imagined battle which still rages in the soul. Those who have once had this experience, too, we are told, should recover within the hearing of the big guns, lest these obsessions undermine their courage and make them cowards and panic-starters despite their will. Only very slowly do even the sanest come back to full realization of what and where they are, what doing, and only gradually do their friends, relatives and home conditions live again in their souls as the past validates itself in the all-absorbing present.

Such, too, is the unprecedented strain of the present war, with its high explosives, the contractions of both time and space, poisoned gases, the fatigue and demoralization deliberately planned by each enemy by continuous day and night bombardment before the infantry advance, that it is no wonder that each belligerent has had to develop a new type of hospital for cases of shock due to these causes. All agree that the nervous system of the belligerents has never been subjected to such a strain, and many hold that this of itself will impair the quality of parenthood perhaps for generations. War is a grim and awful experiment upon human nature, but like vivisection, disease and insanity, it should be studied intensively to find its nature, cause, and if possible its cure and at least its function for the individual and society. The very voluminous data in this field now fairly cry out for more and better interpretation. Raw instinct, feeling and emotion, which are the very roots of human nature, are stripped bare of all their disguises. The motivation of war, however interpreted, is psychological, whether its cause be individual, social, economic, or religious. War is still regarded too much as panics and pestilences were before science explained and controlled them. Hence it is that we should welcome the suggestion lately made of a society planned, to be given an international organization, to study the psychological aspects of this war, selecting literature, making special observations, according to prescribed methods, synthetizing results from all fields, in order that in the end we may have some definite conception of what war really is, does and means. At least the vastness and abundance of the data should not cause them to be negelected, seem common, or go to waste.

4. Will the war tend to increase collectivism at the expense of individual activity and initiative? It stands forth already as the most perfect example the world has ever seen of completely organized teamwork. The individual is only a cog in a vast machine. The subaltern and even the lower officer knows almost nothing, and indeed one high authority has told us that only three men in one of the leading belligerent countries know anything in regard to the general military plan; and very few attempt to understand what is going on in other parts of the line in any front. The rest obey literally, trusting in the wisdom at the top. They do much and perhaps have to face almost certain death in an enterprise that seems to them utter folly, and they have no consolation save their faith that the leaders know it to be for the good of the whole. This is necessary for all effective armies, but in citizens of an autocratic government it comes easier and is more complete than in those pervaded by the spirit of democracy. This, of course, is one of the reasons why wars always favor autocratic and are unfavorable to democratic institutions. This concentra-

tion of power often includes the civic community and almost anything may be committed, forbidden, commandeered, while personal liberty suffers from countless encroachments. So mechanized is war to-day that there is ever less opportunity for brilliant *coups,* acts of self-initiated heroism and daring. So, too, the *esprit de corps* of the army is strong and rigid in enforcing its collective judgment and sentiment, while if internationalism declines, patriotic and perhaps fanatical nationalism is incalculably strengthened. Thus it is no wonder that when soldiers are at last discharged and go back to civil and industrial life, they find it hard to readjust. They have lost positions to others who have gained while they have declined in aptness for their old jobs. Instead of the closer tie of companionship in arms there remains only that of fellow-citizens. They have grown used to taking orders, to being fed, clothed, cared for, and so find it hard to return to doing these things for themselves, and expect governmental consideration in the form of pensions, offices and other favors. They lean on the state that they have served, instead of learning to begin to exercise their own individual powers. In all these ways war is unfavorable to the spirit of democracy and more favorable to monarchical tendencies. A few new and powerful leaders arise because a few men have learned to exercise command, while the masses have learned to obey. War is as necessary for monarchy as peace is for a democracy. One over-emphasizes order, system, control; the other magnifies beyond bounds unrestrained personal liberty. Here is the issue of the present struggle. Germany never had a revolution such as in England and in France swept away the spirit and even the vestiges of feudalism, which Teutonic genius has conserved and transformed into something which at least the neutral world must admire. The least governed people can perhaps best understand the most governed, and yet here our psychology fails to recognize the fact that it is pre-personalities they have made history, and that it is their synthetic organization, one with another, that has created civilization and culture, and that if these elements or units in the body politic, social and industrial, have their freedom, repressed according to any wisdom the wit of man has yet devised, the whole of which they are members is sure, sooner or later, to lose the all-originating power of free and progressive development. Despite the penalties of freedom, such as license, sometimes degenerating to vice and crime, despite disorder, crude, often unsuccessfully and at best oft-repeated trial and error methods, if we believe in man and in a future that is to be greater than the present, we must believe that the American way will lead mankind to an ever higher goal of evolution and emancipation from the countless repressions that dwarf and stunt him in the home, the school, church, industry and state. The German superman is for the people an irridescent dream evolved in order to compensate for the fact of over-institutionalized life, and even the super-state there is the state that now is, while our super-man and state is that which is to be when individual freedom has done its perfect work.

Finally, in view of all this, should we not in this country, along with all our other psychologizing, foster as something especially germane to the spirit of our institutions the study of individualities and racial and all the other very diversified groups which constitute our heterogeneous population, and do so not only for the development of anthropological science, but with the ideal of fitting each one's aptitudes of body, health, native gifts, traits of character, experiences and motor patterns, to just that occupation that best fits his own psychophysic organism, striving to guide each to that environment, industrial, social or cultural, in which his personality will find most incitement to unfold freely? Should not one of our ideals be to give each the kind and degree of self-knowledge that will make not only for maximal self-reverence *and self-control, but for maximal freedom* and the most efficient life? If a democracy achieves greatness it must be not by the method of regimentation or any kind of organization imposed from without, but by finding the place in life for which each is best fitted. Must we not study individuals more than we study vocations, and thus perhaps some day may not the very apex of democratic society be found in its psychology, charged with the responsibility of seeing to it that the best powers of every man are discovered, developed, and put to their highest use?

A TRIAL OF MENTAL AND PEDAGOGICAL TESTS IN A CIVIL SERVICE EXAMINATION FOR POLICEMEN AND FIREMEN

By LEWIS M. TERMAN, assisted in the tests by Arthur S. Otis, Virgil Dickson, O. S. Hubbard, J. K. Norton, Lowry Howard, J. K. Flanders and C. C. Cassingham

On October 31, 1916, the City of San Jose, California, made an unusual experiment, perhaps the first of its kind to be made in this or any country. The experiment in question involved a civil service examination for positions in the police and fire departments, based entirely on standardized mental and pedagogical tests. The experiment was proposed to the writer by San Jose's city manager, Dr. T. H. Reed, and his assistant, Mr. Paul Eliel.[1]

San Jose is a city of about 35,000 population. It employs a force of 48 firemen and 29 policemen, and the last budgets for these two departments were $73,583 and $40,500; a total of $114,083. Considering the size of the departments and the fact that tenure in both is permanent, it seemed highly desirable to find some means of selecting the best material available for the positions to be filled. The original suggestion merely had in view the use of some kind of mental test as supplementary to the usual form of civil service examination along scholastic lines. It was pointed out by us, however, that the proficiency of the candidates in the school subjects could also be much more accurately gauged by the use of standardized tests than by any improvised examination, a point which was quickly appreciated by the authorities responsible. Such an examination was accordingly arranged along the lines to be described presently.

THE INTELLIGENCE EXAMINATION

We were asked whether it would not be feasible to give tests of reaction time, of speed of association, and of certain other special capacities which might be supposed to play a leading rôle in determining the efficiency of a fireman or policeman. It did not seem to us, however, that either our knowledge of the mental "faculties" needed by policemen and firemen, or our present means of testing such hypothetical faculties, would offer sufficient warrant for an experiment of this kind. On the other hand, we know that "general intelligence" can be measured with a fair degree of success, and we have reason to believe that this general intelligence, however we define it, is the most important single factor, apart from moral integrity, in determining fitness for positions of the kind in question. It was decided, accordingly, to limit this part of the examination to the use of the Stanford Revision of the Binet-Simon Intelligence Scale.

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[1] Dr. Reed was formerly professor of economics at the University of California, and Mr. Eliel is a graduate of Stanford University.

In order to save time, the Stanford-Binet scale was given in the abbreviated form, four tests being used out of each age group instead of the usual six (six instead of eight in year XII), and each weighted proportionately heavier. The scale thus abreviated has been found accurate enough for most practical purposes. Mr. Otis has shown that the probable error of the complete form of the Stanford revision, when used with miscellaneous adults testing from about twelve years up is a little over five months. When the scale is split into halves vertically, and only three tests used out of each group (four in year XII), the probable error of a mental age is about 10½ months. Accordingly we may assume that when four tests are used in each year, as in this experiment, the probable error of the resulting mental ages would be a little more than 8 months.

THE PEDAGOGICAL EXAMINATION

The pedagogical tests given were of five classes: reading, writing, spelling, fundamental operations of arithmetic, and arithmetical reasoning.

The reading tests consisted of the Trabue Completion tests B and C and the Thorndike Oral Reading Test.[2] These were scored according to the methods set forth by the authors.

As a test of handwriting, the examinees were directed to write the sentence: "A quick brown fox jumps over the lazy dog", as well as possible at a moderate rate of speed, one minute being allowed. The samples were rated upon the Ayres Scale for Measuring the Quality of Handwriting of Adults.

The spelling test was one which had been devised by Mr. Otis for purposes of more rapid administration than the ordinary test. The even numbered words of Starch's first list of

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[2] See Teachers College Record, Sept. 1914, pp. 67-69. As explained by Thorndike, this is chiefly a test of ability to pronounce words and not a complete test of reading ability.

100 words were chosen as a basis. An alternative spelling of each word was prepared in order that the examinee might merely indicate which was the correct spelling. The words were arranged in pairs as follows:

4. low	( ),	loe	( ).
12. fell	( ),	fel	( ).
26. bruch	( ),	brush	( ).
38. steal	( ),	steel	( ).
44. chaple	( ),	chapel	( ).
54. shroud	( ),	shrowd	( ).
62. leoperd	( ),	lepard	( ).
100. inefectuality	( ),	ineffectuality	( ).

In some cases both words were correct spellings, as No. 38; in other cases neither was correct, as No. 62. This was explained and the examinees were cautioned not to infer that if one spelling was correct the other would necessarily be incorrect, or vice versa.

The tests in fundamental operations of arithmetic were the tests in the adding, substracting, multiplying, and dividing series of single combinations found in Courtis' Standard Tests, earlier style. The times allowed for these tests were respectively 1 minute, 1 minute, 1½ minutes and 2 minutes. The number of correct combinations solved in a given time was the score in each test.

The test in arithmetical reasoning consisted of 25 problems, arranged in approximate order of difficulty, and was very similar to the Courtis reasoning tests. The solution was not required, but merely an indication of the operation involved, whether +, —, ×, or ÷. The proper sign was to be inserted, thus:

1. If a train goes 40 miles per hour for 5 hours, how many miles does it go? 40 5= ans.

16. If a rod of iron 10 feet long is reduced in length to 9.5 feet by twisting, how many feet long must a rod be before twisting to be 20 feet long after twisting? 10 9.5 = ans.

Conditions Under Which The Examinations Were Made

Thirty candidates presented themselves in competition for the ten or twelve prospective openings. Most of these were for positions in the fire department. The writer was present, with seven graduate students to act as assistants. Seven candidates were given the intelligence test simultaneously, each in a separate room of the city hall and with only the examiner present.[3] The only exception to this was in the case of two examinations, to each of which two auditors were admitted. As soon as the first seven candidates had completed this individual examination, all were assembled in another room and given the pedagogical tests in a group. Then seven other candidates were taken through the same procedure, and so on until the thirty candidates had completed the examination.

The individual examinations, including the completion and reading tests, ordinarily consumed a little more than an hour, and the remaining pedagogical tests considerably less than an hour. The rooms in which the examinations were conducted were reasonably quiet and comfortable and the conditions in general were favorable. All of the assistants were students in a class studying intelligence tests, and all had taken extensive instruction in the Stanford-Binet procedure. The responses were taken down as nearly as possible verbatim, and to insure uniformity, the scoring was all checked up by the writer. It was found, however, that few errors had been made by the individual examiners in scoring. Credit for one test had been wrongly given or withheld in the case of nine subjects, and for two tests in the case of one subject. In the latter case the two errors offset each other and left a correct result.

With but one or two exceptions the candidates were entirely amenable and, to all outward appearance, interested. No really serious opposition was met, and only in one case was there any question of invalidation of the test result due to the attitude of the subject. Careful examination of all the records of this subject convinced us that his very low scores were due to stupidity rather than to his obstinate and critical attitude. Naturally, there were some expressions of surprise and also occasional questions regarding the relation between the work of a fireman or policeman and the abilities called for by the tests. Perhaps it would hardly be fair to expect our candidates to see any very intimate bearing of such tests as naming sixty words in three minutes, defining abstract words, reversing in imagination the hands of a clock, giving the moral of a fable, interpreting pictures, finding similarities, or filling a Trabue blank, on the handling of a fire cart or on the traditional duties of a policeman. Nevertheless, several of the candidates, for the most part those who ranked high in intelligence, volunteered their hearty approval of the novel kind of examination. A clerk in one of the city offices became so interested during the day that he asked permission to take the tests himself, just to see what he could do, a privilege which was gladly accorded him.

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[3] The Trabue completion test and the Thorndike reading test were also given at this time.

Personnel Of The Candidates

All of the candidates were American born. All but six were of Western European descent. The exceptions included four Spanish and two of Italian extraction. All spoke English without noticeable accent. Only two were of Irish descent!

The range in age was from 21 to 38 years, the median falling at about 30 years.

From questions regarding the extent of their schooling, it was found that only nine had completed the eighth grade, and that only four had attended a higher school. Five had not completed the sixth grade. Of the four who had attended high school, none had gone beyond the second year. Comparison of the highest grade reached with the age of leaving school revealed the fact that at least half of the candidates were two or more years below grade when they left school. Several had evidently belonged to that group of school children so well known to all teachers because of their all-round inability to make progress in their studies.

The incomes of the candidates during the past year ranged all the way from $420 to $1,350, the median being $960. The salaries of the positions competed for in the fire and police departments begin at $900 per year and increase by annual increments of $100 to a maximum of $1,200, with liberal retiring allowance at the age of 65.

Of the occupations which the candidates were following just previous to the examination, 7 may be classed as unskilled, 15 as semi-skilled or low-grade clerical, and 6 as skilled or high-grade clerical. The occupations of two candidates were not learned.

Results of the Intelligence Examination

The mental levels resulting from the Stanford-Binet test range from "superior adult" to below the borderline of mental deficiency. The actual distribution of "mental ages" was as follows:

M. age	10	10-6	11	11-6	12	12-6	13	13-6	14	14-6	15	15-6	16	16-6	17	17-6	18
No....	1	0	1	1	2	5	4	3	2	6	1	1	1	0	0	1	1

The above table shows the mental ages grouped in ranges of six months, the 12-6 group including the mental ages from 12-4 to 12-9, inclusive, and similarly for the other groups.

Converting the mental ages into intelligence quotients, disregarding actual age above sixteen years, we have the following distribution:

IQ.............	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	100–104	105–109	110–114
Number.........	1	1	2	6	7	4	4	2	1	1	1

The median mental age was 13-5, or IQ 84. The lowest quartile (in this case the lowest seven) fell below IQ 78; the highest quartile (highest seven), above IQ 91.

In the light of Stanford University tests of various social groups the significance of the above results may be indicated as follows: the lowest individual, and probably also the next lowest, may be termed intellectually feeble; the next two (70-74 group) are near the borderline of intellectual feebleness; the next six (75-79 group) are very inferior; the eleven in the two groups 80-84 and 85-89 belong to the "inferior adult" level; the eight between 90 and 109 are "average adults"; and the one reaching 112 belongs distinctly to the level we have designated as "superior adult."

These mental ages and IQ's will doubtless seem very low to those who have been accustomed to draw the line between normality and mental deficiency in adults at the 12-year mental level, or 75 IQ. In reality, of course, there is no clear line of demarcation between normality and feeble-mindedness. The distinction is arbitrary, and whatever standard is taken there will always be more borderline cases than high-grade defectives. Tests of various industrial groups have convinced us that the usually accepted twelve year standard is so high as to include in the "defective" class a fairly large proportion of reasonably efficient unskilled laborers. In all probability not far from five per cent of unselected adults in the average community have an intelligence level not superior to that of the average child of twelve years. It seems that twelve-year intelligence, if backed by physical strength and law-abiding habits, is ample for pick-and-shovel purposes, and probably for many other kinds of unskilled labor. Those who fall as low as 10 years, however, are rarely "able to manage themselves or their affairs with ordinary prudence."

Adults who test in the neighborhood of eleven years may or may not be in danger of becoming social incompetents. Much depends upon their training, their emotional traits, their physical strength, the amount of assistance rendered them by solicitous relatives and friends, the conditions of the labor market, etc. It would be a serious mistake to suppose that intelligence is the only criterion of social and industrial competency.

As we have pointed out elsewhere,[4] the term feeble-mindedness is currently used in two different senses, one referring to the intellectual status of an individual, the other to his inability to get on in the world. It is the failure to make this distinction which has provoked so much discussion, sometimes of acrimonious nature, as to who is feeble-minded. In the hope that it would contribute to a better mutual understanding among the workers, we have suggested that we substitute for the ambiguous term " feeble-minded " the two terms " intellectually feeble " and " socially feeble." The diagnosis of intellectual feebleness is absolute, as intelligence is a definitely measurable thing. The diagnosis of social feebleness will always be relative and less exact, for the reason that one's ability to escape social incompetency is affected by so many extraneous and unpredictable factors of environment and by so many other mental and also physical traits. We have recommended that the term " intellectually feeble " be applied to those who test below 70 IQ by the Stanford-Binet scale. For adults this would include in the group of intellectually feeble those testing as low as 11 years. Our data lead us to believe that the large majority testing below this point are also likely to fall into the class of socially feeble, on any reasonable interpretation of the term. Those testing between 70 and 75 may or may not be socially feeble, but the range of the latter class doubtless extends in some cases as high as 80 IQ or even higher.

In testing school children we have found that those who fall below 75 IQ are rarely able to do the work above the seventh grade with average marks, however long they remain in school, although such children are sometimes promoted to the eighth grade or even to the high school " because of age and maturity." Those below 70 IQ rarely do much of the work beyond the sixth grade satisfactorily. A child of IQ as low as 85 is rarely able to make much headway in the average California high school, while few are able to graduate from a high school who fall as low as 90. It should be stated, however, that the limits of IQ within which various degrees of school success are attainable have not yet been ascertained with accuracy. Several Stanford University students are at work on this problem.

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[4] "The Binet Scale and the Diagnosis of Feeble-Mindedness," *Journal of Criminal Law and Criminology*, November, 1916.

The minimum IQ compatible with efficiency in the case of policemen or firemen is not yet known, easy as it would be to ascertain it. In the absence of a more definitely established standard we recommended that in this case all candidates be rejected who graded lower than 80 IQ. This recommendation was accepted by the city manager, with the result that ten of the thirty candidates were thus eliminated. The remaining twenty candidates were given a final rank order by combining the rank order resulting from the intelligence test with that resulting from the pedagogical tests taken together, giving double weight to the intelligence test. This procedure is arbitrary, but it is probably as defensible as any of the other methods which suggested themselves.

Our own examination was only one of four criteria employed by the city manager in determining the fitness of the candidates. The other three included a thorough medical examination of each candidate, a series of physical tests (such as strength, running and rope climbing), and personal and moral qualities as indicated by previous record, testimony of disinterested persons, etc. We are not here concerned with these aspects of the total examination, further than to state that all testing above 80 IQ were placed on the eligible list except two who were rejected on the physical tests, and that all who tested below 80 were rejected without further consideration. The latter group included four individuals who, at the time of the examination, were already serving in the fire department as "extras", having gotten their positions under the political system of city government which existed before the city manager came into office. The IQ's of these four men were 63, 74, 77, and 79.

CORRELATIONS OF THE MENTAL AND PEDAGOGICAL TESTS

In intercorrelations for mental age, vocabulary (a part of the Stanford-Binet test), monthly salary at the time of the examination, and the scores earned in the several pedagogical tests were ascertained by the Spearman footrule, and the R's were then converted into r values by a conversion table. The results are set forth in the following table:

	Mental age	Vocabulary	Trabue completion	Arith. reasoning	Reading	Spelling	Arith. fundamentals	Handwriting	Salary
Mental age		.68	.67	.81	.48	.32	.55	.43	.61
Vocabulary	.68		.60	.72	.51	.41	.59	.44	.35
Trabue completion	.67	.60		.65	.26	.30	.57	.17	.60
Arith. reasoning	.81	.72	.65		.41	.31	.71	.34	.52
Reading	.48	.51	.26	.41		.60	.31	.48	.45
Spelling	.32	.41	.30	.31	.60		.40	.20	.43
Arith., fundamentals	.55	.59	.57	.71	.31	.40		.50	.30
Handwriting	.43	.44	.17	.34	.48	.20	.50		.26
Salary	.61	.35	.60	.52	.45	.43	.30	.26	

It will be observed that all of the correlations are positive and that most of them are fairly high. The probable error is .078. In the main, however, mental age, vocabulary, completion and arithmetical reasoning give higher correlations with one another than reading, writing, spelling, and fundamentals give with one another or with the several tests of the first group. The first four are preëminently tests of general intelligence, the last four depend more upon special factors. Salary gives higher correlations with the first group than with the last; that is, it depends more upon general intelligence than upon such special factors as are involved in reading, writing, fundamentals and spelling.

If we consider mental age, vocabulary, arithmetical reasoning, and ability in the completion test as dependent mainly upon general intelligence, as would be suggested by the table of correlations, it is interesting to find the average correlation of each item with this group. Doing this we have the following:

	Average correlation with mental age, vocabulary, arithmetical reasoning, and Trabue
Spelling	.335
Handwriting	.345
Reading	.415
Salary	.52
Fundamentals	.605
Completion	.64 (with other three)
Vocabulary	.666 (with other three)
Mental age	.72 (with other three)
Arith. reasoning	.728

The average correlation of reading, handwriting, spelling, and fundamentals with each other is .405. It is evident, therefore, that the special factors operating in these tests are about as much independent of one another as they are independent of general intelligence. On the other hand, the average correlation of mental age, vocabulary, completion ability, and arithmetical reasoning with each other was .688, showing that these tests draw heavily upon a common factor.

The abbreviated Stanford-Binet scale was split vertically in halves in order to find the correlation of each half with the other. When treated in this way each half of the abbreviated scale becomes a doubly abbreviated scale, having only two tests in each group, except year XII, in which there are three. The mental ages were then computed on each of these doubly abbreviated scales by giving each test double weight. The resulting mental ages gave a correlation of .69 between the two halves. This is large enough to indicate a fairly high reliability for the form of the scale used.

In similar manner the subjects were ranked separately in the Trabue completion tests B and C, the resulting correlation being .71. This high correlation is what should be expected, considering the almost identical nature of the two completion tests.

Especially noteworthy is the high correlation of salary with intelligence as indicated by such tests as mental age, vocabulary, Trabue, and arithmetical reasoning. As an indication of general intelligence salary is far more significant than proficiency in one of the school subjects.

The correlation of salary with age was positive but surprisingly low, namely .21. We may conclude, therefore, that the earning capacity of individuals like those which compose our group is determined far more by general intelligence than by length of service.

The enormous superiority of skilled over unskilled workers in general intelligence is shown in the following table:

Occupational group	Unskilled	Semi-skilled	Skilled
Range of IQ	63 to 89	74 to 96	84 to 112
Average IQ	75.5	85.2	98.3

When similar data are available for large numbers in all the main occupational groups, intelligence scales will play an important rôle in vocational guidance.

Between age and mental age there was no significant correlation (— .05). The correlation of age with completion ability and arithmetical reasoning was —.07 and .03, respectively. Insofar as our subjects are representative of their several ages it appears that the tests we have used are absolutely uninfluenced by age differences between 21 and 38 years—that they are little affected by the incidental experiences of adult life.

The correlation between mental age and amount of schooling could not be ascertained accurately for the reason that 21 of the 30 candidates had left school either in the seventh or eighth grade. It was also impossible to learn in all cases the exact number of years a candidate had spent in school. It is significant, however, that the three subjects who failed to reach the sixth grade tested at 74, 77, and 78 IQ, and that the two who reached the second year of high school tested 108 and 112. The average IQ of those who left school at the seventh grade was 81.3; of those who left at the eighth grade, 84. This is in harmony with numerous investigations which have shown that inferior ability is one of the important factors operating in favor of elimination from school. Such facts would warrant excluding from examination for positions of this kind all applicants who have not completed a certain minimum of school work, say that represented by graduation from the eighth grade, or preferably the high school.

Those who assisted in the tests were asked to compare the results of each test with the expectations aroused by the general personal appearance of the subject. No effort was made to get a quantitative expression of the agreement or disagreement, but every assistant met with one or more cases in which the test result was decidedly higher or lower than the appearance of the subject had suggested. It seems highly desirable that some means be employed to serve as a check upon the influence of "good looks" in the sifting of candidates for a position.

MISCELLANEOUS OBSERVATIONS

It would be highly instructive to compare men and women workers as regards the salary outlook for various grades of intelligence. The median IQ of the eighteen candidates who were placed in the eligible list was 89. Seven of these tested between 80 and 85. However long they remain in school, individuals of the 80 grade have the greatest difficulty in completing satisfactorily the work of the eighth grade; those of the 90 grade, the high school course. Yet the salary which these men will be paid as policemen and firemen exceeds by far that of the average California teacher, who according to an investigation now in progress, rarely tests as low as 100 IQ and usually above 110. It is unnecessary to dwell upon the economic injustice revealed by such findings.

The following data regarding individual applicants may be of interest:

No. 30,[5] whose IQ was 63, is employed in his father's store at a salary of $25 per month. Since this man is 34 years of age and lives in a community where the common unskilled laborer readily earns from $50 to $60 per month, it appears that he belongs in the socially feeble as well as in the intellectually feeble group. Notwithstanding this fact, he had previously secured a position as an "extra" in the fire department. His father is said to be a man of some local prominence.

Information regarding No. 29 (IQ 67) was obtained from a responsible clerk in one of the city offices. Our informant, who had commanded a militia company in which No. 29 was a private, states that he had long considered him to be definitely feeble-minded. The best job this applicant had held was as stationary fireman in a hotel. He had lost this and at the time of the examination was without regular employment. Again the intellectual feebleness indicated by the intelligence test is supported by the suggestion of social feebleness.

Our above mentioned informant had also had No. 28 (IQ 71) in his militia company, and states that, although the latter is extremely stupid, he is not considered feeble-minded. He has worked as a hotel porter at $40 per month, and as railroad signalman at $65 per month. It is true that the duties of railroad signalmen are extremely simple, but it is also true that the careful and attentive performance of these duties is a matter of great importance. Whether it is safe to entrust such a task to a person of 71 IQ is doubtful, to say the least.

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[5] The numbers here used refer to rank order in intelligence.

No. 27, aged 34, IQ 74, claims to have earned $80 per month as a stage carpenter. He had also served as an " extra " in the fire department. No other information was available.

No. 26, aged 30, IQ 77, was a laborer in a saw mill at $40 per month. He had also served a term in the regular army, rising to the rank of sergeant. After failing in this examination he returned to the army.

No. 24, IQ 77, had worked as a paper hanger at $18 per week, and had served as an " extra " in the fire department.

No. 23 was a teamster, No. 22 was a deliveryman for a grocery store and had served as an " extra " in the fire department, and No. 21 had no occupation other than as an " extra " on the fire force. These tested at 78, 78, and 79, respectively.

No. 20, aged 34, IQ 81, had served several years as a policeman in an eastern state at $65 to $80 per month.

Our informant stated that he expected No. 16 (IQ 83), to test much higher than he did. This individual is a street car conductor and is said to be very popular with his patrons because of his genial good nature, his interest in people and his memory for names. He is an Irishman and his racial social traits have doubtless led his friends to overestimate his grade of intelligence.

No. 1, aged 31, IQ 112, had completed the second year of high school, had taken an extensive correspondence course in the International Correspondence School along commercial lines, and had earned as high as $125 per month as a salesman. His purpose in seeking a position in the fire department was to secure leisure for carrying on another correspondence course in expert accounting. His mother had been a teacher.

The clerk in the city hall who was given the tests as requested, earned an IQ of 113 and ranked first in both the mental and pedagogical tests. He was graduated from high school and attended a university for one year. He is said to be very efficient.

In conclusion, while emphasizing the tentative nature of our experiment we would point out the need of further work in this direction, and especially the desirability of correlating the results of mental tests with the later success of the accepted candidates. Our data lead us to believe that intelligence tests are likely to be found a valuable aid in the selection of applicants for certain types of positions. In order to utilize fully the advantages of the test method for this purpose, however, it will be necessary to secure comparative norms of performance for various occupational groups.

THE LEGIBILITY OF A TELEPHONE DIRECTORY

By Professor John Wallace Baird, Clark University

I. Introduction

The New York Telephone Company recently found itself confronted by a serious practical problem. Their telephone directory contained nearly one thousand pages; these pages were approximately nine by twelve inches, and the volume was nearly an inch and a half thick. Since many names of new subscribers were being added with every new issue of the directory, it seemed inevitable that future issues of the volume would become too unwieldy and cumbersome to handle effectively. Ineffective handling of the directory on the part of the user of the telephone must result in misreadings and errors; and since the New York Telephone Company handles millions of calls every day, it is a matter of paramount importance that the directory should be printed in such form as to insure the greatest possible accuracy of reading.

All of these circumstances raised the interesting practical problem in the minds of the Engineering Department of the Telephone Company: Is it not possible to condense the size of the telephone directory, and thus make future issues of it less difficult to handle and less subject to misreading? And if so, what is the best plan to follow in improving the form of the directory? Accordingly, Mr. W. A. Bentley of the Engineering Department of the New York Telephone Company, consulted with the writer; and an experimental investigation of the problem was undertaken. The writer is indebted to Mr. Bentley for valuable coöperation and helpful suggestions throughout the investigation; and to Messrs. L. W. Robinson, B. K. Rhoades and P. K. Houston, employees of the New York Telephone Company, for their diligent and painstaking work in obtaining the data upon which this study is based.

II. Experimental Investigation

A. Materials and Method of Procedure

A general survey of the situation indicated that the most hopeful method of bringing about the desired result would consist in printing four columns of subscribers' names to the page, instead of the existing three-column arrangement. This plan would of course result in a considerable reduction in the number of pages in the directory; but it seemed probable that an increase in the number of columns upon the page would make it more difficult to find the telephone number of any given subscriber,—that is, that an increase in the content of the page would decrease the legibility and would result in an increase of time required for consulting the directory.

In order to counteract this probable tendency toward increased illegibility two expedients were devised:

a. Indentation. When a reader consults a printed list, such as the names in a telephone directory, his misreadings are frequently due to the fact that his glance fails to follow the printed line accurately; in hastily glancing across the column, from the subscriber's name at the left to his telephone number at the right, the reader's regard frequently wanders either upward or downward to an adjacent line, instead of following a horizontal direction. In consequence of this he reads the telephone number which appears in the adjacent line, immediately above or immediately below the number sought. Such misreadings or errors of reference are especially frequent in cases where the printed letters do not completely fill the line,—that is, where a blank space intervenes at the center of the column, and where, therefore, no horizontal line is present to serve as a guide to the eye-movement of the reader. Now it seemed probable that this particular type of misreading could best be obviated by printing the parallel columns of names and numbers in alternately indented arrangement, —that is, by indenting every alternate line of the list of names and numbers, and thus printing it a short distance to the right or left of the preceding and succeeding lines. This form of printed page we shall call Page-Arrangement C (see illustration, p. 32).

b. Leading. Previous investigations of legibility[1] have shown that the blank space which appears between adjacent lines of a printed page is a potent factor in determining the legibility of the page. Within certain limits degree of legibility varies directly with the width of this blank space (or thickness of leading). Unfortunately, in the present instance it was not feasible to insert any considerable thickness of leading between adjacent lines for the reason that the insertion of one-eighteenth of an inch would result in a loss of all of

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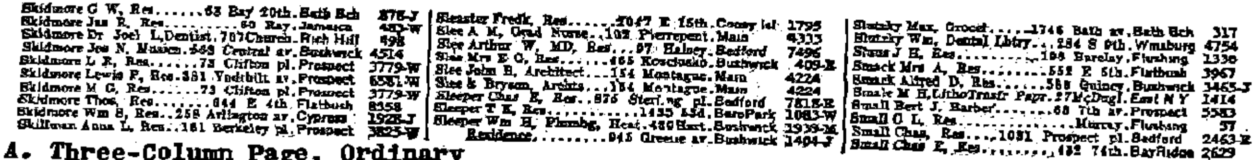
[1] Notably B. E. Roethlein, The Relative Legibility of Different Faces of Printing Types. *Amer. Jour. Psychol.*, XXIII, 1912, pp. 1-36.

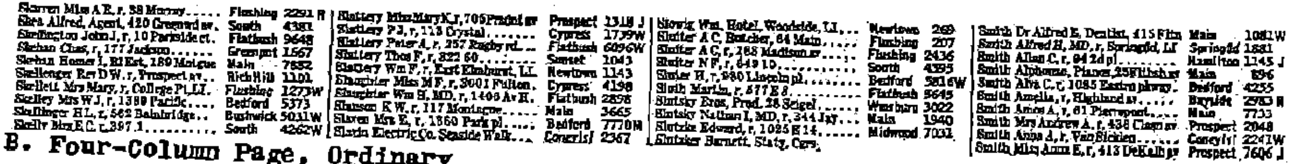


Skidmore G W, Res......63 Bay 20th.Bath Bch 876-J
Skidmore Jas R, Res..............60 Bay.Jamaica 483-W
Skidmore Dr Joel L,Dentist.707Church.Rich Hill 498
Skidmore Jos N, Musicn.662 Central av.Bushwick 4514
Skidmore L R, Res.......73 Clifton pl.Prospect 3779-W
Skidmore Lewis F, Res.381 Vndrbilt av.Prospect 6581-W
Skidmore M G, Res.......73 Clifton pl.Prospect 3779-W
Skidmore Thos, Res........644 E 4th.Flatbush 8358
Skidmore Wm B, Res..258 Arlington av.Cypress 1928-J
Skillman Anna L, Res..161 Berkeley pl.Prospect 3825-W

Sleaster Fredk, Res......2047 E 15th.Coney Isl 1795
Slee A M, Grad Nurse..102 Pierrepont.Main 4333
Slee Arthur W, MD, Res...97 Halsey.Bedford 7496
Slee Mrs E C, Res.......466 Kosciusko.Bushwick 409-R
Slee John B, Architect...154 Montague.Main 4224
Slee & Bryson, Archts...154 Montague.Main 4224
Sleeper Chas E, Res..876 Sterling pl.Bedford 7818-R
Sleeper T K, Res..............1435 53d.BoroPark 1083-W
Sleeper Wm H, Plumbg, Heat.489Hart.Bushwick 1939-M
Residence..........945 Greene av.Bushwick 1404-J

Slutsky Max, Grocer.....1746 Bath av.Bath Bch 317
Slutzky Wm, Dental Lbtry...284 S 9th.Wmsburg 4754
Stuss J H, Res...........198 Barclay.Flushing 1330
Smack Mrs A, Res..........552 E 5th.Flatbush 3967
Smack Alfred D, Res.......588 Quincy.Bushwick 3465-J
Smale M H,LithoTrnsfr Papr.27McDougl.East N Y 1414
Small Bert J, Barber........68 7th av.Prospect 5583
Small O L, Res.....................Murray.Flushing 57
Small Chas, Res....1091 Prospect pl.Bedford 2463-R
Small Chas E, Res..........482 74th.BayRidge 2629

A. Three-Column Page, Ordinary



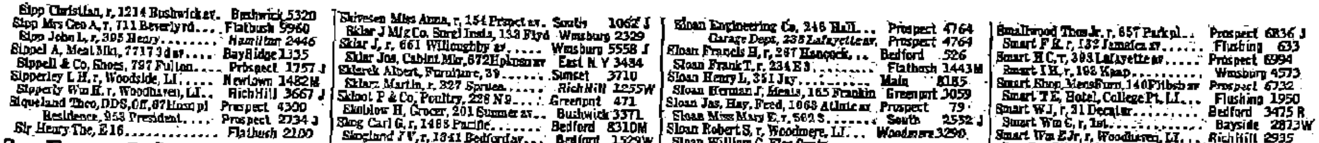
Skarren Miss A E, r, 38 Murray...... Flushing 2291 R
Skea Alfred, Agent, 420 Greenwood av. South 4381
Skeffington John J, r, 10 Parkside ct. Flatbush 9648
Skehan Chas, r, 177 Jackson......... Greenpnt 1567
Skehan Homer L, Rl Est, 189 Montague Main 7652
Skellenger Rev D W, r, Prospect av.. Rich Hill 1101
Skellett Mrs Mary, r, College Pt, LI. Flushing 1273W
Skelley Mrs W J, r, 1389 Pacific..... Bedford 5373
Skellinger H L, r, 562 Bainbridge.. Bushwick 5011W
Skelly Mrs E C, r, 397 1.......... South 4262W

Slattery Miss Mary K, r, 706 Prsdnt av Prospect 1318 J
Slattery P J, r, 113 Crystal....... Cypress 1739W
Slattery Peter A, r, 257 Rugby rd... Flatbush 6096W
Slattery Thos F, r, 822 60......... Sunset 1043
Slattery Wm F, r, East Elmhurst, LI Newtown 1143
Slaughter Miss M F, r, 3001 Fulton. Cypress 4198
Slaughter Wm H, MD, r, 1408 Av H. Flatbush 2898
Slawson K W, r, 117 Montague...... Main 3665
Slaven Mrs E, r, 1860 Park pl..... Bedford 7770M
Slazin Electric Co, Seaside Walk... ConeyIsl 2367

Slowig Wm, Hotel, Woodside, LI... Newtown 269
Sluiter A C, Butcher, 64 Main...... Flushing 207
Sluiter A C, r, 268 Madison av..... Flushing 2436
Sluiter N F, r, 649 10............. South 4395
Sluter H, r, 980 Lincoln pl......... Bedford 5816W
Sluth Martin, r, 577 E 8........... Flatbush 9645
Slutsky Bros, Prod, 28 Seigel...... Wmsburg 3022
Slutsky Nathan I, MD, r, 344 Jay... Main 1940
Slutzke Edward, r, 1025 E 14....... Midwood 7031
Slutzker Barnett, Staty, Cgrs,

Smith Dr Alfred E, Dentist, 415 Fltn Main 1081W
Smith Alfred H, MD, r, Springfld, LI Springfld 1881
Smith Allan C, r, 94 2d pl......... Hamilton 1145 J
Smith Alphonse, Planos, 259 Fltbsh av Main 896
Smith Alva C, r, 1085 Eastrn pkwy.. Bedford 4255
Smith Amelia, r, Highland av...... Bayside 2983 R
Smith Amos A, r, 61 Pierrepont..... Main 7733
Smith Mrs Andrew A, r, 438 Clason av Prospect 2048
Smith Anna A, r, VanSicklen....... ConeyIsl 2241W
Smith Miss Anna E, r, 413 DeKalb av Prospect 7606 J

B. Four-Column Page, Ordinary



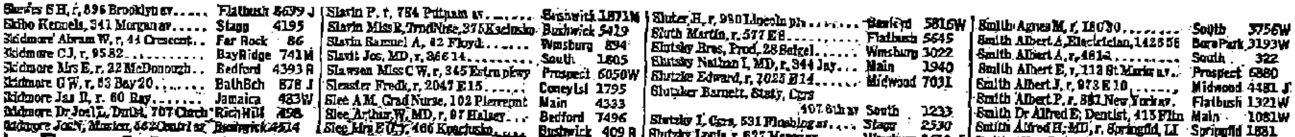
Sipp Christian, r, 1214 Bushwick av. Bushwick 5320
Sipp Mrs Geo A, r, 711 Beverly rd.... Flatbush 9960
Sipp John L, r, 395 Henry.......... Hamilton 2446
Sippel A, Meat Mkt, 7717 3d av..... BayRidge 1335
Sippell & Co, Shoes, 797 Fulton..... Prospect 1757 J
Sipperley L H, r, Woodside, LI...... Newtown 1482M
Sipperly Wm K, r, Woodhaven, LI.. RichHill 3667 J
Siqueland Theo, DDS, Off, 87 Hanson pl Prospect 4300
Residence, 953 President.... Prospect 2734 J
Sir Henry The, E 16.............. Flatbush 2100

Skivesen Miss Anna, r, 154 Prspct av. South 1062 J
Sklar J Mfg Co, Surgl Insts, 133 Flyd Wmsburg 2329
Sklar J, r, 661 Willoughby av...... Wmsburg 5558 J
Sklar Jos, Cabint Mkr, 672 Hpknsn av East N Y 3434
Sklarek Albert, Furniture, 39....... Sunset 3710
Sklarz Martin, r, 327 Spruce....... RichHill 1255W
Skloot P & Co, Poultry, 228 N 9.... Greenpnt 471
Skoblow H, Grocer, 201 Sumner av.. Bushwick 3371
Skog Carl G, r, 1483 Pacific........ Bedford 8310M
Skogland J V, r, 1341 Bedford av... Bedford 1529W

Sloan Engineering Co, 246 Hall... Prospect 4764
Garage Dept, 235 Lafayette av, Prospect 4764
Sloan Francis H, r, 287 Hancock... Bedford 526
Sloan Frank T, r, 234 E 3.......... Flatbush 1443M
Sloan Henry L, 351 Jay............ Main 8185
Sloan Herman J, Meats, 165 Franklin Greenpnt 3059
Sloan Jas, Hay, Feed, 1063 Atlntc av Prospect 79
Sloan Miss Mary E, r, 562 S........ South 2552 J
Sloan Robert S, r, Woodmere, LI... Woodmere 3290
Sloan William C, Elec Cntr.

Smallwood Thos Jr, r, 657 Park pl.. Prospect 6836 J
Smart F K, r, 132 Jamaica av...... Flushing 633
Smart H C, r, 393 Lafayette av..... Prospect 6994
Smart I H, r, 198 Knap............ Wmsburg 4573
Smart Shop, MensFurn, 140 Fltbsh av Prospect 6732
Smart T E, Hotel, College Pt, LI... Flushing 1950
Smart W J, r, 31 Decatur.......... Bedford 3475 R
Smart Wm C, r, 1st................ Bayside 2873W
Smart Wm E Jr, r, Woodhaven, LI... RichHill 2935
Smedley J H, r, Central av......... Woodmere 3643W

C. Four-Column Page, Indented



Skevies G H, r, 896 Brooklyn av...... Flatbush 5699 J
Skibo Kennels, 341 Morgan av...... Stagg 4195
Skidmore Abram W, r, 44 Crescent.. Far Rock 86
Skidmore C J, r, 95 82............ BayRidge 741M
Skidmore Mrs E, r, 22 McDonough.. Bedford 4393 R
Skidmore G W, r, 63 Bay 20....... BathBch 878 J
Skidmore Jas R, r. 60 Bay......... Jamaica 483W
Skidmore Dr Joel L, Dntst, 707 Chrch Rich Hill 498
Skidmore Jos N, Musicn, 662 Centrl av Bushwick 4514

Slavin P, r, 784 Putnam av........ Bushwick 1871M
Slavin Miss R, TrndNrse, 375 Ksclusko Bushwick 5419
Slavin Samuel A, 62 Floyd....... Wmsburg 894
Slavit Jos, MD, r, 366 14......... South 1805
Slawson Miss C W, r, 345 Estrn pkwy Prospect 6050W
Sleaster Fredk, r, 2047 E 15....... ConeyIsl 1795
Slee A M, Grad Nurse, 102 Pierrepont Main 4333
Slee Arthur W, MD, r, 97 Halsey... Bedford 7496
Slee Mrs E C, r, 466 Kosciusko..... Bushwick 409 R

Sluter H, r, 980 Lincoln pl......... Bedford 5816W
Sluth Martin, r, 577 E 8........... Flatbush 5645
Slutsky Bros, Prod, 28 Seigel...... Wmsburg 3022
Slutsky Nathan I, MD, r, 344 Jay... Main 1940
Slutzke Edward, r, 1025 E 14...... Midwood 7031
Slutzker Barnett, Staty, Cgrs
407 6th av South 1233
Slutzky I, Cgrs, 531 Flushing av.... Stagg 2530
Slutzky Louis, r, 627 Marcy av..... Wmsburg 3619 J

Smith Agnes M, r, 180 30.......... South 3756W
Smith Albert A, Electrician, 1426 56 BoroPark 3193W
Smith Albert A, r, 481 2.......... South 322
Smith Albert E, r, 113 St Marks av.. Prospect 6880
Smith Albert J, r, 973 E 10....... Midwood 4481 J
Smith Albert P, r, 881 New York av. Flatbush 1321W
Smith Dr Alfred E, Dentist, 415 Fltn Main 1081W
Smith Alfred H, MD, r, Springfld, LI Springfld 1881
Smith Allan C, r, 94 2d pl......... Hamilton 1145 J

D. Four-Column Page, Leaded

the space which had been gained by adopting the four-column arrangement of page. Hence it was decided to determine whether the inserting of a modicum of leading (one-seventy-second of an inch) would not have the desired effect.

We selected four arrangements of page, and had these four prepared by the printer; and the investigation then set out to discover which page-arrangement possesses the greatest advantages. These four arrangements of page were as follows: 1. A four-column page, set by the printer in exactly the same form as the existing page of the directory with the sole difference that under the new arrangement the page contained four columns instead of three.[2] This arrangement of page is referred to hereafter as the B Arrangement, or the Four-Column Page *Ordinary* (see illustration). 2. A page was arranged exactly like the foregoing, excepting that every alternate line was indented,—hereafter referred to as the C-Arrangement, or the Four-Column Page *Indented.* 3. The next arrangement differed from the ordinary four-column page only in that instead of being set 'solid' the lines were separated from one another by half a point of leading,—hereafter referred to as the D-Arrangement, or the Four-Column Page *Leaded.* 4. In order to have a standard of comparison we also employed pages from the existing directory; this arrangement we shall refer to as the A-Arrangement, or the Three-Column Page *Ordinary.*

The investigation consisted essentially in determining how much time is required to find the telephone number of a given subscriber selected from each of these four arrangements of page. The detailed procedure in conducting the investigation was as follows: Each of the twelve pages to be tested (an I-page, an M-page and an S-page, printed in each of the four page-arrangements) was mounted upon a sheet of cardboard and bound in the form of a booklet. An appropriate room was set apart for the experiments; and a carefully-planned schedule of experimental sittings was arranged before the experiments began. When any reagent[3] entered the room he was placed in a comfortable seat, which occupied a constant position. After a 'ready' signal, the name of a subscriber was either read aloud to him by the experimenter or was shown to him upon a printed card. The reagent first repeated this name aloud in order to make sure that he had perceived it correctly; then he opened the booklet which lay before him on the table and proceeded to find the telephone exchange and the number listed opposite the given name. The experimenter, by means of a stop-watch, determined the amount of time required for finding the exchange and number,—measuring the time which elapsed from the instant when the reagent opened the booklet until he pronounced the name of the exchange and the telephone number. This procedure was carried through without change for all reagents.

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[2] The form of letter used in printing page-arrangements B, C and D was slightly different from that which had been used in former issues of the directory (page-arrangement A),—the innovation consisting essentially in a slight condensation of the width of the letters.

[3] The individuals who served as subjects in these experiments will be referred to as reagents.

In order to eliminate the influence of accidental conditions, and to make our results not only more accurate and reliable but also more subject to general interpretation, the following precautions were observed: Thirty-two reagents were employed, and care was taken that these individuals should represent various degrees of intelligence and various degrees of practice and skill in the use of the directory. These thirty-two individuals were all chosen from among the employees of the Telephone Company; eight were selected from the installation force (Plant Department), eight from the solicitors and other outside workers of the Commercial Department (Commercial Outside Department), eight from the office force of the Commercial Department (Commercial Inside Department), and eight from the Directory Department. Individuals were selected who possessed various degrees of visual acuity and refractive defect; and in order that the conditions of our experiment might further approximate the actual conditions under which the directory is ordinarily consulted, various degrees of natural and artificial illumination were included in the experiments. In order further to eliminate accidental circumstances, both easy and difficult pages were included in the test; pages whose names began with the initials I, M and S were found to vary sufficiently in difficulty to fulfil the necessary conditions here The names were presented to the reagent alternately in oral and in visual (typewritten) fashion. Each of the thirty-two reagents was given thirty tests with each of the four arrangements of page, making a total of more than thirty-eight hundred individual tests. The experiments were arranged in such fashion as to eliminate or at least to neutralize the effects of practice, the testing of the various page-arrangements being so distributed that no page-arrangement would profit more than any other from the practice which the reagent had acquired in the course of the experiments. Care was taken to provide that the experimental sittings should be so short as not to give rise to fatigue.

B. Results

The numerical results of these experiments are presented in Table I. The numbers tabulated represent the average times required for finding the telephone number of a given subscriber (finding-time) by each of the four groups of individuals, with each of the four arrangements of page,—all of these finding-times being recorded in seconds. The numbers in the lowest line of the table represent the average finding-time for all reagents of the four groups,—that is, for the thirty-two reagents.

TABLE I

he numerical data tabulated here represent the average finding-time of each group of reagents, for each he four arrangements of page,—that is, the average time required for finding the telephone number of iven subscriber with each of these four variations of printed page,—together with the general average, verage finding-time of all thirty-two reagents. Each average in the first four lines of the table is comted from two hundred and forty individual tests; and each general average, set down at the foot of each umn, is an average of nine hundred and sixty individual tests.

REAGENTS		A Three-column page,—ordinary	B Four-column page,—ordinary	C Four-column page,—indented	D Four-column page,—leaded
ployees of "Plant" ep't.	Average finding-time. Mean variation......	13.96 sec. 5.36 sec.	16.98 sec. 7.23 sec.	15.22 sec. 6.34 sec.	14.63 sec. 5.91 sec.
ployees of "Commer-ial Outside" Dep't...	Average finding-time. Mean variation......	10.21 sec. 4.42 sec.	9.82 sec. 3.89 sec.	9.69 sec. 3.15 sec.	8.20 sec. 2.67 sec.
ployees of "Commer-al Inside" Dep't. ...	Average finding-time. Mean variation......	10.25 sec. 2.80 sec.	9.81 sec. 2.75 sec.	9.56 sec. 3.96 sec.	8.56 sec. 2.54 sec.
ployees of "Direc-ry" Dep't..........	Average finding-time. Mean variation......	7.00 sec. 2.22 sec.	6.16 sec. 1.93 sec.	6.04 sec. 1.69 sec.	5.65 sec. 1.30 sec.
	General average.....	**10.36** sec. ± 3.69 sec.	**10.69** sec. ± 3.95 sec.	**10.14** sec. ± 3.79 sec.	**9.28** sec. ± 3.20 sec.

A survey of this table shows that the average time required for finding a telephone number in the old directory (three-column page) is 10.36 seconds. When the names of the subscribers are printed in a four-column arrangement, without indentation and without leading, the finding-time is slightly increased,—being raised to 10.69 seconds. When the four-column page is printed in indented arrangement the finding-time is reduced to 10.14 seconds. And when the four-column page is very slightly leaded the finding-time is reduced to 9.28 seconds. This means that the ordinary four-column page and the ordinary three-column page are about equally legible; that the use of the indented form of column increases the legibility by about five per cent.; and that the insertion of half a point of leading increases the legibility by about thirteen per cent.

The statements in the foregoing paragraph are based upon results obtained from all four groups of reagents. The members of these four groups represented widely different stations in life, and widely different degrees of practice and skill in consulting such a work of reference as the telephone directory.[4] If now we ignore the results obtained from the installation force,—who were manual laborers and infrequent users of the telephone,—and average the results of the three other groups, we find that the leaded four-column page excels the old three-column page by approximately eighteen per cent. The members of these three groups represent the most frequent and perhaps the average and typical users of the telephone; and hence it seems probable that eighteen per cent. is a more accurate measure of the superior excellence of the four-column leaded arrangement than the percentage quoted in the foregoing paragraph, since the employees of the Plant Department probably represent a class of society which makes but infrequent use of the telephone directory.

And since the employees of the Directory Department possess a degree of skill and dexterity in the use of the directory which is seldom approximated by the average subscriber, it would be interesting to ignore their results and to consider only the results obtained from the employees of the Commercial Department. The sixteen members of this latter group probably represent the average users of the telephone more adequately than the members of the other two groups. The finding-times of these sixteen individuals show an average of 10.24 seconds for the three-column page, and 8.38 seconds for the four-column leaded page,—a superiority of slightly more than eighteen per cent. These considerations indicate that the four-column leaded page is equally advantageous for the ordinary individual and for the highly expert individual. In any case, it is obvious that the four-column leaded page is much more legible than the page of the old directory, and considerably more legible than either of the other two page-arrangements tested.

In consequence of this investigation the New York Telephone Company selected the D-Arrangement of page, and in the next issue of their directory the names of their subscribers were printed four columns to the page, the lines of print being separated from one another by half a point of leading. The new directory is not only more legible than the old by more than ten per cent. but it also reduces the bulk by approximately twenty per cent. (a decrease of about two hundred pages).

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[4] The group from the Plant Department represented skilled manual labor rather than the ordinary type of manual labor. The group from the Commercial Outside Department represented the average type of outdoor salesman. The group from the Commercial Inside Department represented a combination of high-class clerical labor and inside salesmanship. The group from the Directory Department represented the maximum degree of practice and skill in using the directory.

Two other features of our results may be mentioned here. The indented form of page proves to be but little superior to the ordinary form of page; indenting turns out to be much less efficacious than leading. If we may assume that alternate indentation really facilitates the reader's endeavor to follow the horizontal line of print, our data would seem to indicate that misreadings which are due to the crowded condition of the printed page are of much greater significance than misreadings which are due to one's tendency to wander away from the horizontal line of print.

Our data furnish a measure of the effects of practice in using the telephone directory. The average finding-time of the most practiced group of reagents,—the employees of the Directory Department,—is only about two-fifths as long as the average finding-time of the least practiced group,—the employees of the Plant Department,—the average finding-time being 6.46 seconds for the former group and 15.20 seconds for the latter group.

MENTALITY TESTING OF COLLEGE STUDENTS[1]

By W. V. Bingham
Carnegie Institute of Technology

I. The Demand for Student Testing.
  a. Six-fold source of the present practical demand.
    1. Selection of students for admission.
    2. Classification of students according to ability.
    3. Determination of individual aptitudes and abilities.
      i. For educational guidance.
      ii. For vocational counsel.
    4. Diagnosis of failures.
    5. Coöperation with the placement bureau.
    6. Measurement of the results of instruction.
  b. Relation to the theoretical interest in individual differences.
II. The Problems Classified.
  a. Devising and adapting tests.
  b. Standardizing tests.
  c. Calibrating tests; methods of scoring.
  d. Evaluating tests.
  e. Establishing norms.
III. A Program of Coöperative Research.
  a. Assembly of scattered information now available.
  b. Selection of a nucleus of uniform standard tests.
  c. Inter-laboratory coöperation on research problems.

I. The Demand

The rapidly growing demand upon the departments of psychology in colleges and universities to render immediate, practical service through the application of scientific methods of measurement to the mental traits of students, has its root in at least six distinguishable needs. The first of these appears in connection with the selection of students for admission, and takes the form of a plea for some measure of a student's native ability, with which to supplement the information obtainable from secondary school records, entrance examinations, and personal interviews with the applicants.

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[1] Read before the American Psychological Association in New York, December 29, 1916.

The need for a ready means of classifying students into sections according to ability is a second cause of the request for mentality testing of college students.

More frequently mentioned and infinitely more difficult of accomplishment is the task of testing for special abilities and vocational aptitudes, in order that the individual student may be given educational counsel and vocational direction, or, as Kitson has phrased it, in order that the curriculum may be adjusted to the student.

The adjustment of the student to the curriculum is a complementary task in which the deans and student advisors are calling upon the psychologists to assist by bringing mentality tests to bear in diagnosing the causes of a student's failure to do good work.

A fifth demand comes from the placement bureau, which seeks information regarding the abilities of the outgoing seniors with which to supplement records of scholarship and the opinions of the instructors.

The sixth demand is for a means of measuring the results of instruction and, by testing the abilities of students before and after their period of study, determining the comparative efficiency of rival schools, curricula, methods and educational ideals.

An additional motive which has impelled many to turn their efforts in the direction of mentality testing of undergraduates is one which arises from within the science itself: the scientific interest in the exploration of individual differences, their nature, amount and causes. Indeed, historically, this is the original spring of interest in student testing. (4) Moreover, many of the actual problems of testing have been solved, or will in the future be faced, by psychologists whose interest is purely scientific and who care not a whit about the possible utility of the tools they forge. Some of these scientists deplore the trend toward application, and profess a high degree of apprehension lest the pursuit of truth about human nature be deflected and led into confusion by the demands of the practical. A wiser attitude is the one which maintains a cautious circumspection regarding the possibilities and the demands of applied psychology, but finds, nevertheless, in these demands, a powerful impetus to pure science, an augmented motive toward painstaking research, a stimulus and not a menace.

The advantages of coöperation do not, I maintain, accrue solely to the party of the second part. While striving toward an accumulation of information and insight which will have some worth for the individual tested, we are constantly elaborating methods and gathering data upon which pure psychology can draw in its studies of character, intelligence and other traits of mind. It is through the further accumulation of facts—measurements, profiles, distributions, correlations—that the psychologist of the next generation will find it possible to replace both the arm-chair analyst's hazy and verbose picture of human nature and the laboratory analyst's skeleton-like caricature of it, with an account that is both scientifically accurate and recognizably adequate to the living reality.

There ought then to be no hesitancy. The hearty support and active coöperation of workers in the realm of pure psychology is absolutely essential to the development of the applied science; and it is with confidence that we who are primarily occupied with application, turn to our colleagues of purity unimpugned for help in attacking precisely these problems of mental analysis, measurement, diagnosis and prognostication which are being forced upon us by the college administrator's demands for student testing.

II. The Problems Classified

An inventory of pertinent problems discloses a need for research in almost every quarter of the field; devising tests, standardizing tests, evaluating tests and establishing norms.

The assertion recently current that the greatest need is for an accumulation of data with tests and procedures already standardized rather than for the devising of more tests, does not hold today. We need more and better tests, particularly tests of special abilities similar to Seashore's measurements of the components of musical ability (14) or Stenquist's assembly tests (16) or Thurstone's tests of capacity to handle ideas involving relations of space and form.[2] We need also carefully graded measures of general intelligence which are more accurate in the differentiation of the higher ranges of superior adult capacity than are the Binet tests for example in differentiating capacities at the lower end of the intelligence scale. There is an insistent call—to which not many psychologists have as yet had the temerity to harken—for conative and affective tests, for measures of such components of character and personality as persistence of motives, relative strength of interests, development of taste and of capacities for enjoyment. (See, however, Guy Fernald's test of grit which he calls an achievement capacity test (6); H. T. Moore's method of getting at the strength of instincts by means of association reactions (12); Kelley's measures of interests (9); Thorndike's newest scales for measuring the affective processes involved in esthetic appreciation of simple designs and of poetic quality (18); and Webb's notable attempt at demonstrating the existence of a second common factor (20).

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[2] Not yet published.

Necessity exists not only for the invention of new tests but also for the simplification, adaptation and improvement of tests previously proposed, and for the provision of alternative and equivalent tests for use in getting repeated measures of the traits in question.

New and old tests alike call for standardization after they have been adapted to the conditions imposed by the exigencies of college testing. Standardization of a test involves not only determining the best content and form, and the best procedure that can be used in giving the directions and in providing for fore-exercise, repetitions, uniformity of incentive and so on; it also implies making the instructions clear, simple and direct—fool-proof against both the examiner and the student to be tested. Published accounts of tests can hardly err on the side of excessive simplicity and explicitness of instructions.

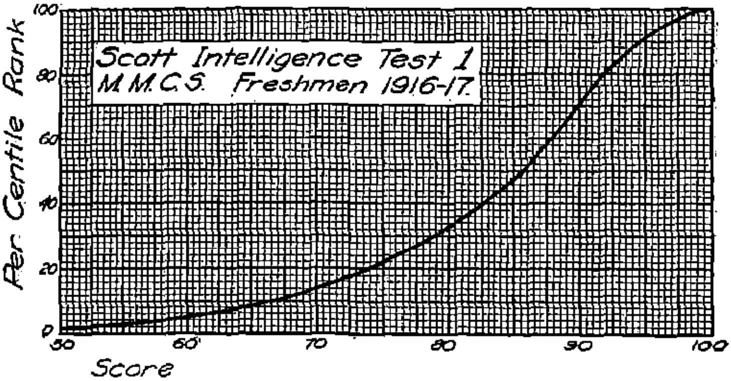
Still another aspect of standardization, to which all too little attention has ordinarily been accorded, is the determination of the optimal method of scoring the results. Shall a student's accuracy score in a logical inference test, for example, be the total number of right reactions, or the right minus the wrong, or the ratio of the right to the difference between the right and the wrong? This is a question that can be answered either intuitively (as it ordinarily is) or empirically by finding which method of scoring gives the best distribution and the highest correlation with some other available objective measure of the trait in question. This empirical determination of the optimal method of scoring a test for any specified purpose, we at the Carnegie Institute of Technology, following Thurstone, are accustomed to speak of as the *calibration* of the test. I venture the suggestion that some of the discouraging results recently obtained by Bell (2) from tests of students are partially attributable to the use of arbitrary instead of empirical calibrations of the tests used.

Another large group of important research problems centers about the evaluation of tests already standardized and calibrated. Just what is the psychological interpretation of each of the tests under consideration? What information of practical significance emerges from studies of correlation between the test results and estimates of intelligence, school standings, later vocational success, etc? What is the relative practicability and utility of the test in question, when compared with other tests, as to susceptibility to the effects of practice, of coaching, and of familiarity with similar test situations? To cite an illustration, just how much or how little information about a student's motor-coördination and fatiguability are lost when one gives the tapping test as a group test, using pencil and paper and ten-second trials, instead of employing tapping board and kymograph with the full procedure as specified by Wells?

In attempting to measure native intelligence how much is gained or lost by devoting an available half hour to giving Scott's complex group test No. 1 (13), instead of spending the same time in giving separate tests of opposites, verb-objects, analogies, addition, easy problems, understanding directions and matching proverbs? Numerous similar questions of relative utility are now being answered in many laboratories by the one best method of actual trial. (5, 8, 10, 11, 22.)

After a series of tests for college students have been devised or adapted, standardized and calibrated, and evaluated with reference to their psychological significance and their relative utility, there remains the stupendous task of establishing norms for the various groups to be measured and of determining the boundaries and border-line zones within which it is possible to make definite statements as to the degree of probability of a student's success or failure in the work he is undertaking.

In the laboratory which I represent, we have found it most convenient to throw our data always into the form of ogive curves of distribution or percentile graphs. These graphs are simple to plot, and blue prints of them form extremely convenient means of reference to the available norms. One sees at a glance the range, the median score, the quartiles and the ten-percentiles, and can instantly translate any new individual score into terms of precise relative rank among a hundred members of the group in question. The accompanying cut shows such a percentile distribution of the scores for accuracy in Scott's intelligence test No. 1., (13) made by 97 young women of the present entering class of the Margaret Morrison Carnegie School (the woman's vocational college of the Carnegie Institute of Technology), on the first day of their attendance last fall. It is clear from the form of the curve that either the test is too easy for this group or the method of scoring for accuracy is not severe enough. But for immediate purposes it serves a highly useful function as a percentile scale of measurement. It is inserted here as a sample of thirty such ogives prepared this year from data on tests of students, by L. L. Thurstone, for use in our Bureau of Mental Tests.



A SAMPLE OGIVE

III. A Preliminary Program Of Coöperative Research

Such a formidable array of varied problems would discourage the psychologist who is invited to undertake the testing of college students, if he were not fully aware that already many laboratories are actively engaged in attacking precisely such tasks as these. A recent questionary by Professor Bird T. Baldwin (1) discloses no less than forty-one members of the American Psychological Association who report research now in progress on problems apparently germane to one or the other of the four main divisions of inquiry outlined above. Other psychologists, too modest perhaps, to classify their tentative efforts under the caption of research, are doing student-testing although they are not listed in the Baldwin report.

To facilitate the approach of the day when psychologists shall be in a position to render with adequacy the services which the colleges are asking of them, it is important that three steps be taken at once, toward effective coöperation.

First in importance is the assembly of information now available. Scattered through our laboratories are many files of test data that have not been published; many minor experiments on methods of giving, calibrating or evaluating tests that have never been reported; many good ideas for new or different tests of adults which have not as yet been fully elaborated; many discoveries of labor-saving devices in the calculating and recording of results which have not as yet been passed on to other workers. It has been proposed that these accumulations be pooled, and that the American Psychological Association Committee on the Standardization of Mental Measurements be requested to aid in making this material more promptly available to all.

A second step which may soon be timely, involves the selection of a small group of tests which all can agree to use in such a uniform manner that comparison may be facilitated,—the opposites test, the analogies test, the completion test, and the logical memory test, for example.

The third step in our immediate program of research is the parcelling out among the laboratories of the numerous research problems that most need investigation: the provision of duplicate sets of tests of known equivalence; the invention of new tests and the improvement and adaptation of old ones; the comparison of group testing with individual testing; and in general the standardization, calibration and evaluation of each of the many tests whose usefulness has been suggested or already demonstrated.

The completion of such a program is not a matter of a year or a decade. Only with the accumulations of painstaking results from many laboratories over a period of years, carefully checked up by comparison with later performance of the students tested, both in their college courses, and later in the various pursuits to which their efforts are directed after graduation, will we be in a position to give to undergraduates of succeeding college generations individual counsel superior to that of unaided common sense and personal insight.

REFERENCES

1. BALDWIN, B. T. A Survey of Psychological Investigations with Reference to Differentiations between Psychological Experiments and Mental Tests. Report of the Committee on the Academic Status of Psychology, American Psychological Association. Printed by the Committee, Swarthmore, Pa., December, 1916.
2. BELL, J. CARLETON. Mental Tests and College Freshmen. *Journal of Educational Psychology*, 1916, Vol. 7, pp. 381-399.
3. BINGHAM, W. V. Some Norms of Dartmouth Freshmen. *Journal of Educational Psychology*, 1916, Vol. 7, pp. 129-142.
4. CATTELL, J. MCKEEN, and FARRAND, LIVINGSTON. Physical and Mental Measurements of the Students of Columbia University. *Psychological Review*, 1896, Vol. 3, pp. 618-648.

5. Chassell, Laura M. Tests for Originality. *Journal of Educational Psychology*, 1916, Vol. 7, pp. 317-328.
6. Fernald, Guy. An Achievement Capacity Test: A Preliminary Report. *Journal of Educational Psychology*, 1912, Vol. 3, pp. 331-336.
7. —— ——. The Defective Delinquent Class Differentiating Tests. *American Journal of Insanity*, 1912, Vol. 68, pp. 523-594.
8. Hollingworth, H. L. Correlations of Abilities as Affected by Practice. *Journal of Educational Psychology*, 1913, Vol. 4, pp. 405-414.
9. Kelley, Truman Lee. Educational Guidance. *Teachers College, Columbia University Contributions to Education*, 1914, No. 71, pp. 116.
10. King, I., and Gold, H. A Tentative Standardization of Certain Opposites Tests. *Journal of Educational Psychology*, 1916, Vol. 7, pp. 459-482.
11. Miles, Walter R., and Butterworth, Julian E. A Tentative Standardization of a Completion Test. *Journal of Educational Psychology*, 1916, Vol. 7, pp. 329-336.
12. Moore, Henry T. A Method of Testing the Strength of Instincts. *The American Journal of Psychology*, 1916, Vol. 27, pp. 227-233.
13. Scott, Walter Dill. Selection of Employees by Means of Quantitative Determinations. *The Annals of the American Academy of Political and Social Science*, Philadelphia, May, 1916, Publication No. 999, pp. 182-193.
14. Seashore, C. E. The Measure of a Singer. *Science*, 1912, Vol. 35, pp. 201-211. See also *University of Iowa Studies in Psychology*, No. VI; *Psychological Monographs*, No. 69, 1914, Vol. 16, No. 3.
15. Simpson, Benjamin R. Correlations of Mental Abilities. *Teachers College, Columbia University Contributions to Education*, 1912, No. 53, pp. 122.
16. Stenquist, J. L., Thorndike, E. L., and Trabue, M. R. The Intellectual Status of Children who are Public Charges. *Archives of Psychology*, 1915, No. 33, pp. 1-52.
17. Thorndike, E. L. Educational Diagnosis. *Science*, 1913, N. S. 37, No. 943, pp. 133-142.
18. —— ——. Tests of Esthetic Appreciation. *Journal of Educational Psychology*, 1916, Vol. 7, pp. 509-522.
19. Washburn, Margaret Floy. A Study of Vassar Freshmen. *Vassar Quarterly*, 1916, Vol. 2, pp. 15-20.
20. Webb, E. Character and Intelligence. *British Journal of Psychology, Monograph Supplements*, 1915, Vol. 1, No. 3, pp. ix+99.
21. White, Sophie D., May, Sybil, and Washburn, M. F. A Study of Freshmen. Minor Studies from the Psychological Laboratory of Vassar College, No. 31. *American Journal of Psychology*, 1917, Vol. 28, pp. 151-154.
22. Whitley, Mary T. An Empirical Study of Certain Tests for Individual Differences. *Archives of Psychology*, 1911, No. 19, pp. 146.
23. Wissler, Clark. The Correlation of Mental and Physical Tests. *Psychological Review, Monograph Supplements*, 1901, No. 6, pp. 1-61.
24. Woodworth, R. S., and Wells, F. L. Association Tests. *Psychological Monographs*, 1911, Vol. 13, No. 57, pp. 1-85.

WHAT IS APPLIED PSYCHOLOGY?

L. R. GEISSLER

The answer to the question: What is applied psychology? depends (a) upon the meaning of the word 'psychology', and (b) upon an understanding of the differences between 'applied' or its synonyms and 'pure' or its synonyms. The term 'psychology' may be defined from various points of view; for example, psychology is said to be the science of mind or consciousness, or the science of behavior or conduct, or the science of mental structures and functions, or, most generally, as the science of mental life. Strictly speaking, this last definition is too broad, because mental life includes, among others, the moral, aesthetic, logical and speculative aspects which are not subject-matter of psychology but belong to such mental sciences as ethics, aesthetics, logic, metaphysics, etc. To give, then, in a preliminary way a positive limitation to our term, we may define psychology as the science of mental life in its structural, functional, genetic, and social aspects, and indicate later in detail what these terms imply.

By 'applied psychology' we mean what is sometimes called practical psychology or psychotechnics or psychotechnology as opposed to 'pure' or 'theoretical' or 'general' psychology. In order to understand fully the differences between the two groups, it seems desirable to make a more extensive comparison, applicable to all 'general' and 'applied' sciences, because such a procedure will at the same time indicate the relation of applied psychology to other branches of knowledge and may thus help us to be sure of our own ground and consistent in our point of view.

It is sometimes stated that 'pure' science is interested in facts for their own sake or for the sake of merely knowing them, while applied science studies facts for utilitarian purposes. But it may be doubted whether the first of these two attitudes is ever realized in its extreme form, and if so, whether it is a truly scientific attitude. Nor is it any more reasonable to go to the other extreme and demand that each newly discovered fact should at once be assigned its utilitarian or practical value. It might be interesting to determine how many pure or abstract facts discovered more than ten years ago are still waiting for their practical application. The results of psychology, in particular, have frequently been arraigned as being too abstract and theoretical to be readily utilised in those concrete and practical events in which mental life plays an important part. This criticism is due to a failure to understand fully the differences between general and applied psychology.

Our general comparison will be based on the following five categories: aim, standpoint, problem, scope, and method, with their underlying principles. For the sake of greater transparency and easier treatment they have been condensed into the following schema, which will be further explained and illustrated by reference to various sciences in general and to general and applied psychology in particular.

In the first place, then, the ultimate *aim* of all general sciences is to extend and improve human knowledge. To appreciate its significance in the concrete, we may be permitted to indulge in a little speculation about its origin, based on the assumption that the childhood of the human race is reflected, at least in a measure, in the childhood of the individual. We may thus imagine that the first impetus to acquire knowledge came from an instinctive 'browsing' which in some of our ancestors was so strong as to manifest itself even after their more or less immediate bodily wants were satisfied and thus led to what we now call 'instinctive curiosity'; for this original, aimless browsing with its accidental rewards in the first crude discoveries probably afforded sufficient pleasure to make it self-perpetuating. The step from this leisurely browsing to an intentional searching for new and better ways of meeting certain situations probably depended upon the fact that the original discoveries could frequently be utilised. In this way the instinct of curiosity acquired a twofold biological value, for it could be indulged in either for its own satisfaction, as the forerunner of our modern 'purely intellectual pleasures'; or for the sake of making future conditions of life more comfortable, and future behavior or conduct more efficient. Now if 'pure' scientists are born and not made, they must have the browsing instinct in its 'purer', original form, for they take their keenest delight in the discovery of new truths. The aim of the applied sciences, on the other hand, is more prosaic, for they strive to enrich and improve the conditions and phases of human life and conduct, that is, they try to help us master or control difficult situations or meet them with more successful responses. This aim is attained by accumulating a body of facts bearing on these situations and responses, while the actual application of this knowledge is carried on by the practical expert. We have thus a *science* and an *art*

General or Pure or Theoretical Sciences	Practical or Applied Sciences or Technology
AIM	
To extend and improve Human Knowledge	To extend and improve the conditions and phases of Human Life and Conduct
STANDPOINT	
of Objectivity or Universal Validity as expressed in Scientific Laws	of Subjective Particularity or Individual Interest in Utility
SCOPE	
depends upon Inherent Similarity of all facts of a science or aspects of knowledge	depends upon Inherent Frequency of factors composing concrete events
PROBLEM	
to discover or establish instances of universal similarity or validity to trace their origin or development to explain their causal connections	to analyse situations and responses (or events) into variable and constant or essential and unessential components to trace their interrelations to modify these components so as to produce same results more efficiently
METHOD	
Observation and Experimentation identical as to Comparison, Repetition, Accumulation, Modification, Elimination, Measurement, different as to Simplification, Isolation, Abstraction, Induction, and Classification	Observation and Experimentation identical as to Comparison, Repetition, Accumulation, Modification, Elimination, Measurement, different as to Differentiation, Separation, Correlation, Deduction, and Standardization

of teaching, of medicine, of engineering, of agriculture, etc. To be sure, sometimes both science and art are represented in the same person; but likewise pure and applied science may occur in the same individual, as when a psychologist interested in the problems of color-blindness engages in testing his subjects for the purpose of showing them how best to overcome their handicap. As a matter of fact, the distinctions which are to be drawn in this paper between pure and applied sciences are perhaps somewhat overemphasised for the purpose of clearer *thinking* and better *understanding* only, and it is readily granted that in actual practice there are many transitions and fusions.

The ultimate aim of pure psychology is, according to the general principle, to extend and improve our knowledge of mental life with regard to its structural, functional, genetic, and social aspects. We do not use the phrase 'mental life' in any technical sense, but include in it all varieties of conscious and semi-conscious experiences in their normal, subnormal, and abnormal forms and in their fully and incompletely developed stages, both in human and other living beings. By the structural aspects of mental life we have reference to the most common elementary and complex experiences ranging from the simplest and more or less abstract and meaningless sense-impressions through the perceptions of external objects and their interpretations to the highest forms of intellectual complexity, as ideas, concepts, judgments, thoughts and also the emotions and voluntary choices and actions. The functional aspects involve the organization of our experiences on the basis of attention, memory, recognition, imagination, comparison, and reasoning. The genetic aspects include the development of mental life in the individual and in the race, while the social aspects involve those changes in mental life which are due to the social intercourse among human beings. We might summarise these statements by saying that general psychology aims to study the ultimate or essential nature and constitution of mental life or experience as a whole. While, for example it tries to find out how we reason and form judgments, it does not seek to determine whether our judgments are logically correct, or morally sound, or aesthetically valuable or in harmony with other metaphysical speculations.

On the other hand, applied psychology aims to investigate and improve those conditions and phases of human life and conduct which involve mental life, especially in its social aspects, since practically all human activity is nowadays carried on as a function of social intercourse. The solidarity and vital fitness of human society does not so much depend upon the physical likeness of its members as upon the harmonious interaction of their minds, which are of such great variety and complexity that any two of them will resemble each other only in a general way. And yet these minds are constantly entering into each other's situations to which prompt and sometimes delicately balanced responses are required from both parties. In such events mental life is perhaps the most important factor, because it complicates the conditions and phases of human response or behavior to an unpredictable degree. These situations require therefore careful study, in order to improve, if possible, the conditions under which the two parties have to react upon each other and thereby exert also a beneficial influence upon their mental life.

Every discovery of a new fact, intentional or unintentional, is of course an extension of human knowledge and an enlargement of the conditions of human life and conduct. But it cannot help to improve either unless it can be viewed from certain scientific standpoints. Radio-activity, for example, remained an isolated, unintelligible phenomenon until it could be incorporated into physics as fitting under its well established laws of nature. And as soon as this was accomplished, radium began to exert its beneficial influence upon human life and conduct. The general sciences take for their *standpoint* an objective attitude which transcends the interests of the individual and looks for the universal validity of their facts that is expressed in the form of scientific laws. To use an example from psychology, take the fact that human beings can pay attention. General psychology, accordingly, asks, in which forms and stages of mental life is attention possible, what is attention, how many kinds or degrees of it occur, how long may it last, how many items may it include in a single moment, how does it change with age, sex, inheritance, and environment? and like questions. The answers give us the psychological laws of attention. Like other sciences, general psychology purposely eliminates or disregards unessential details and especially accidental individual differences, because they obscure the universal validity of its laws. Consequently, all scientific laws involve the assumption that all essential conditions remain constant.

In the case of the applied sciences, however, the standpoint is the very opposite. Here every concrete situation is an object of investigation in itself, appealing to the subjective interests of certain individuals on account of its immediate utility or threatening harmfulness. It becomes now a question, for example, how the law of gravity can be applied to aerial navigation, or, how certain laws of chemical action can be used in fighting particular diseases, etc. The significance of this principle of subjective particularity for the standpoint of applied psychology is obvious. While general psychology, for example, reduces our daily actions to a universal schema typified in the simple reaction experiment, applied psychology studies these same actions as nearly in their original complexity and concreteness as experimental control of conditions will allow; and the more this ideal is approached, the more applicable will be the results. Recall, for example, the testing of witnesses as to their fidelity, reliability, credulity, suggestibility, etc., or the studies of the influence of humidity and temperature on quality and quantity of work produced, or the diagnosis for musical ability, or the effectiveness of certain advertisements, and others. In all these cases the situations presented to the individual tested and the responses required from them are usually very similar to those found in actual life. Consequently, the results obtained should not be generalized to the extent of making them seem applicable to different circumstances or different individuals. In other words, we should not expect applied psychology to arrive at scientific laws of universal validity.

The rapid accumulation of scientific results since the days of Aristotle, and especially during the last three centuries, has made it absolutely necessary to classify all items of human knowledge into separate sciences, whose *scope* and subject-matter must be definitely outlined according to certain ultimate principles. In the case of the pure sciences the principle involved is that of the inherent similarity of the facts grouped together, so that, for example, observations on the atomic constitution of the universe or its parts belong to chemistry, while the structural and functional elements and interrelations of the same universe and its parts belong to the physical sciences. Again, the same universe in so far as it exhibits signs of life, past, present or future, is studied by the biological sciences; and in so far as it manifests mental life it belongs to the mental and historical sciences. It is thus evident that at bottom the scope of all pure sciences is the same, but the grouping and relating of facts is based upon the inherent similarities of the facts or aspects of knowledge. To indicate the scope of general psychology in particular, it confines itself, as pointed out before, to the structural, functional, genetic, and social aspects of mental life wherever it is mainfested. It is therefore not limited to the human normal adult individual, but its various branches include also the mental life of infants, children, adolescents, senescents, of abnormal and subnormal persons, of savages and civilized people, past and present, of small and large social units, and also of animals and plants. One of the special branches studies the relations between mental changes and physical changes in the external world, while another branch seeks to correlate mental and neural changes.

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In all these branches the standpoint remains the same, that is, they study mental changes with a view toward the universal validity of the facts discovered.

The scope of the applied sciences is based on an entirely different principle. Here such facts are grouped together under a single science which frequently constitute the same concrete situation or require the same concrete response from human beings. Thus the various branches of the science of engineering are differentiated from each other on the basis of specialized tasks and divided into mechanical, civil, naval, sanitary, architectural, efficiency, illuminating, and other kinds of engineering, each group trying to meet certain situations whose inherent resemblance is based on their complexity, that is, on the concurrence of similar factors in similar arrangements. If one examines the factors which constitute a concrete situation from the standpoint of the general sciences to which they may belong, one will find in most cases a number of such sciences are represented which are sometimes not very closely related to each other. Consequently, in order to specialise in any single applied science it is necessary to study at least to some extent all those general sciences upon which its facts are based. Hence the student of medicine, to give a single example, is required to know biology, physics, chemistry, and sometimes psychology, besides anatomy, physiology, embryology, pathology, etc. Still more extensive must be the foundations of applied psychology, because its scope includes every possible situation or response which involves mental life. Since it is impossible within the short span of a human life-time to cover this ground, it becomes necessary to develop special branches of applied psychology which are to be cultivated by specialists in each field. So far the development of these subdivisions has been left to chance interests of individuals or to public demands. But the time seems ripe to systematize and organize the efforts of building up an applied psychology equal in rank to that of other applied sciences, and the author hopes that this task will be faciliated by the Journal of Applied Psychology, the plans for which had been slowly shaping themselves in his mind for some time.

In outlining the scope of applied psychology we cannot be confined to the field as so far actually cultivated, but must include in our discussion the possible extensions which are provided for in the formulation of the general principle as adapted to our special topic. According to it the scope of applied psychology is the study of those conditions of human life and conduct, that is, those concrete situations and responses, in which the mental life of human beings is an important factor. The *situations* may be roughly classified into three groups, namely, those which arise (a) from the individual's hereditary equipment, (b) from his physical environment, and (c) from his social environment. The first division would include the study of individual mentalities of sex, age, race, special talent, genius, criminal, types of character, individual differences and such defects in mental equipment as do not involve abnormalities but only developmental retardation; and this branch might be called *diagnostic psychology.* The next subdivision will study the influences of climate, weather, humidity, temperature, nutrition, sanitational and other environmental conditions upon mental life and receive the name environmental or better *bionomic psychology.* The third group comprises the influences of tradition, customs, beliefs, superstitions, myths, religions, panics, wars, strikes, and such institutional forces as administration, organization, discipline, and others, upon the mental life of the individual or the group and may therefore be called *socionomic psychology.* It is to be distinguished from social or sociologic psychology, which is a branch of general psychology, not only by scope, but also by aim, standpoint, problem and method.—The *responses* which involve mental life may also be grouped into three classes, (a) vocational, (b) recreational, and (c) communicational activities. The *psychology of vocational activities* will include the study of mental factors involved, for example, in legal, medical, educational, industrial, commercial, and other skilled and unskilled work. The *psychology of recreational activities* will study, among other topics, the mental life involved in artistic creations and enjoyments, in playing games and musical instruments, in singing, taking part in sports and athletics, in more passive amusements, in pursuing hobbies and similar pastimes and other leisurely occupations. The *psychology of communicational activities,* finally, will investigate the mental factors involved in reading, writing, speaking, stuttering, using gestures and other symbols, signals and codes, typewriting, stenography, telegraphy, telephoning, printing, interpreting, translating, and the like. To be sure, there may be overlappings, as the same activity may be used for all three purposes; but when this is the case, there will be found also significant mental differences. Nothing has been said here of the psychology of learning, because it may belong into both, general and applied psychology, according to its treatment.

A complete bibliography or a historical sketch of psychology would show that some of the topics here mentioned have been investigated in the very early stages of our science, for instance, reading, writing, religion, beliefs, superstitions, and certain aesthetic experiences. Other topics have begun to occupy the center of interest more recently, as those of individual differences, defects, studies of humidity and temperature, examinations of witnesses, business appeals, and others. Some topics, finally, have not yet received much or any attention, as character-diagnosis, nutritional influences, administrative and disciplinary factors, salesmanship, amusements, and others. Only three of all these numerous topics have so far had their own organs of publicity, the psychology of religious experiences, of education, and of retardation; all the other topics will find representation in the new Journal of Applied Psychology.

The difference in scope between the general and applied sciences is intimately connected with a wide difference in their *problems*. It is frequently stated that the general sciences have at least three or four chief problems, briefly enumerated as those of analysis, synthesis, genesis, and explanation. The first two consist in the discovery and establishment of new instances of universal similarity and validity, the third involves the question of origin and development, and the last searches for causal connections. In some sciences the third, in others, the fourth problem, is of minor importance. In general psychology all four receive about equal attention. The object of analysis is to reduce mental life to its most elementary experiences and to describe the structural composition of mental complexes. The problem of synthesis is to discover the universally valid laws of these elementary and complex experiences and especially to describe their functions in the general course of mental life. The question of mental development is attacked by genetic psychology, which includes child-study, racial, social, and anthropological enquiries. Finally, the problem of explanation is to investigate the relations of mental life to concomitant physical and physiological phenomena.

The problems of the applied sciences are in so far similar as they also include analysis and explanation. Since, however, they deal with complex situations as the conditions of human life and conduct, their first problem is an analysis of these situations, but not for the sake of establishing ultimate elements and universal validity, but rather for the purpose of discovering their constant and variable, or essential and unessential components or contributing factors. The second problem consists in a similar analysis of the responses depending on the particular situations investigated, again for the sake of finding their essential and unessential or constant and variable factors. In a third group of problems an explanation of the interrelations between the situations and responses is aimed at and frequently involves a quantitative or statistical enquiry. The last and perhaps most important problem is to find means of modifying either situations or responses or both in such a way as to attain the same or better results with greater economy of the essential components. Again, as in the case of the general sciences, these four kinds of problems are not of equal weight in all of the applied sciences or in all of their investigations.

Let us illustrate these four problems by a topic of civil engineering, namely, road-building. (1) Among the components of the situation are: a survey of the country through which a new road is to be laid, a measurement of its elevations, a study of its drainage, both on the surface and below it, an analysis of the soil, a study of geological obstructions, of climatic and weather influences, a consideration of the distance of building material and the methods of hauling it, of other existing means of traffic, as rivers, canals, railroads, branch and cross roads, and of the location of communities, dwellings, schoolhouses, churches, stores and similar other social centers of the neighborhoods. (2) An analysis of the responses or phases of human behavior involved will reveal among others the following components: vehicles of traffic used by the inhabitants, the latter's purposes of building the new road, weight of the goods to be shipped over it and of the vehicles used, the desire of avoiding either steep grades or long detours, and the like. (3) The problem of the interrelations between these and the former components require the consideration of the possible width of the road, of its general direction, of grading and shading, of junctions or crossings with other lines of traffic, and of avoidance of sharp curves or hidden turns. (4) The last problem consists in an enquiry into original cost of construction and material, into future expenses of repairs and upkeep, into avoidance of unnecessary bridges, railroad crossings or tunnels, into value of traffic served by the road, and other items.

To consider now the case of applied psychology, the first chief problem is to analyse the mental components of certain situations or conditions of human behavior. A good example may be found in the psychology of salesmanship. Here we have to deal either with the travelling salesman or the travelling customer. The latter may be in one of three possible states of mind, (a) he may know what particular article he wants to buy when entering a store, or (b) he may know what kind of an article he wants to buy, or (c) he may merely want to look around, without definite intentions of buying anything. Each of these states may be further analysed. Among the mental components of (a) may be: a definite idea of the article wanted as to size, color, shape, price, brand, packing, etc.; a definite purpose for the article, a definite or indefinite idea as to where to buy it or try to do so, a definite purpose to buy it, and a definite or indefinite plan as to the next important step after the purchase, manifested frequently by an attitude of haste or of leisure. The salesclerk's responses should be regulated by a knowledge of such components just as much as by the circumstances as to whether the desired article is in stock or "just out." Here, however, we are touching upon the second problem of applied psychology, an analysis of the mental components of human behavior. To continue our previous example, the sales-clerk's response may be of the listless, mechanical, indifferent sort revealing a minimum of mental life,—as is frequently seen in booths for selling tickets to some exhibition or in department stores selling only very low-priced goods,—or it may be inattentive, distracted, as if disturbed by the customer's appearance, and manifesting a lack of interest in the process of the sale, or it may be of the quick, alert, interested, attentive kind that is ready to pierce the customer's mind and to read his thoughts, for the purpose of selling him something else. To proceed now to the third problem, applied psychology has to show the relations of the mental components of the response to the components of the situations. Thus the response of the mechanical, listless sales-clerk may have been conditioned by fatigue, or underfeeding, or poor health, or lack of experience, or underpay, or the like. The last problem of applied psychology is to modify or improve the essential components in situations or responses or both in such a way as to help attain more efficient results. Of course in any concrete case it is necessary that all the other essential non-mental components be likewise improved, otherwise they might offset or destroy any changes that the former might have brought about. This is, of course, the work of the practical expert, but his knowledge of the ways of improving the whole event must come from the various applied sciences that are relevant to the case in question. Illustrations of both, the balanced and the unbalanced efforts of improvement are frequently found among advertisements. Thus an advertisement may be constructed correctly according to psychological principles, but appear in a poor medium, or at the wrong time, or in the wrong community. For example, the writer has in mind a beautiful and attractive streetcar poster of a certain well-known summer school exhibited in a community of another state in which a large summer school was conducted. More frequently it happens that an advertisement correctly employs certain essential psychological principles but violates certain others just as essential. Such mistakes are due, as a rule, to an incomplete analysis of the situation or the expected response.

Since the problems of the general and applied sciences are in partial agreement, that is, in so far as they involve analysis and explanation, we may expect that the two groups will be similar, to some extent at least, with regard to their *method* of investigation, which is the last point of comparison in our schema. In general, both groups of sciences may be said to depend upon the method of observation for the accumulation of their facts, and the more detailed procedure will include the processes of comparison, repetition, modification, elimination, and measurement. These steps are facilitated by the use of experimental control of the factors under investigation. In the general sciences this control is as a rule very rigid and refined and makes it possible to greatly simplify the conditions by isolating the desired components, sometimes with the additional help of mental abstraction, until as a result the ultimate, unanalysable elements are discovered. The latter may then be recombined in old and new ways, and by this inductive procedure the universal validity of their laws is established. For an illustration let us watch the botanist in his study of the nutritive processes of a certain plant. He will plant a large number of seeds of that plant in various kinds of soil, which he has either artificially prepared by mixing or whose chemical composition he has otherwise previously analysed. The amounts of water, heat, light, etc., administered daily to each specimen are carefully measured and recorded and the rate of growth is observed in minute detail, including among others the number, size, and first appearance of roots, stems, leaves, buds, flowers, fruit, etc. These observations are repeated, sometimes for years, and with still further modifications until all accidental factors are eliminated. The results are then compared with a careful microscopical analysis of the cells of the different parts of the plant, and any doubtful facts must be repeatedly tested and verified, before a universally valid description of the nutritive processes of this plant is obtained. On the basis of the results obtained the plant receives a certain classification in the botanial system. Such is, if not always the actual, at least the ideal method, and with minor variations, due mostly to differences in subject-matter, it is also employed by general psychology. Again, in any single investigation of some particular problem some of these steps may be omitted, others may have to be very much extended, while some may be combined into a single act. Likewise the actual temporal order of these stages in the procedure may vary from time to time, both in the general and the applied sciences.

The latter differ from the former in several respects. Since their problem of analysis is not to find ultimate elements, but to single out the constant from the variable or the essential from the unessential components, they do not have to carry the process of simplification to the highest degree, so that they may substitute for it the methods of differentiation and separation. Furthermore, since they always deal with a concrete situation or response, a too rigid and refined control of conditions might destroy the object of investigation and either substitute for it an artificial product which is not true to life, or at least prevent the study of the relations of the components to each other and to the concrete whole. The latter step constitutes the method of correlation and takes the place of induction. It is often supplemented by a process of deduction which consists in referring the separated components to the laws of the corresponding general science and inferring from them such changes in the concrete event under investigation as promise more efficient results in the end.[1] This leads to the last step in the method, that of standardization, which takes the place of classification and is based, in part at least, on the results obtained by the corresponding general sciences. Standardization thus is the process by which the fourth problem of the applied sciences is to be solved.

With the exception of this last step the differences in the methods of the two groups of sciences are in some cases very much obliterated. Nevertheless it seems important to keep the two separated in thought at least, in order to avoid confusions and conflicts in actual practice. Thus a clear understanding of these differences will be helpful in deciding the present claims of the value of mental tests. An attempt to settle this dispute is of course beyond the scope of this paper, although it is hoped that the latter may contribute its share toward a satisfactory solution of the difficulties involved. Instead, it seems more appropriate to conclude with a concrete illustration of the experimental procedure in a problem of applied psychology.

Suppose, then, it was desired to discover which persons out of ten possible suspects had been witnesses of or taken part in a certain event, especially as the participants might try to conceal connection with it. The first thing to do is to obtain, or if necessary to construct, a standardized list of one hundred irrelevant words which are sufficiently general in character and which refer to nearly every possible general topic of life except to the event in question. Then make out a new list of 25 to 50 'relevant' words, each referring more or less pointedly to some phase of this event, (this step involves differentiation). Then mix the two lists in such a way that there are always two or three irrelevant words in succession, but the relevant words are sometimes scattered singly amongst them, sometimes follow in small groups of two, three, or four (modification). Now submit each of the ten subjects singly (separation) to the following tests: after explaining and illustrating to the subject that he is to respond as quickly as possible to each word said to him with the first word occurring to him, pronounce the first word and at the same time start a stopwatch. As soon as the subject begins to reply stop the watch, write down what he says and the length of time it took to answer (measurement). This process is continued until the complete list has been submitted. At a later trial (repetition) the following modification may be introduced: ask the subject to respond as quickly as possible, whenever he can, with the same word that he used before, but if it does not readilly recur to give the very first new word that comes to his mind. Calculate next the time averages and their mean variations for each whole list, for the irrelevant, and the relevant words separately and correlate them with the kind of replies given. A comparison of the quantitative and qualitative data will help in the elimination of those persons whose results show no marked differences in their responses to the relevant and irrelevant words. In the case of the others it is not only possible, by deduction from the general laws of emotion, to say that they have been present at the event, but one may sometimes infer from the nature of their replies to what extent they have taken part in the concealed event. We have not indicated in this abbreviated illustration the various precautions that may be necessary in order to control the conditions of experimentation and that should be considered essential factors in the method.

In place of a summary of this systematic enquiry into the nature of applied psychology a final word may be said about the relations between applied psychology as a *science* and as the *art* of making practical applications of its results to concrete events in daily life. The question is sometimes raised: Are the scientific results of psychology so fully established that we are justified in making practical use of them? An affirmative answer can be given only with reference to a few topics, and even here only with certain limitations and qualifications. A true selection of these topics can be made only by a psychologist who is a specialist and thoroughly familiar with the whole field of his science, and all applications should be made either under his supervision or with his full approval. But if he wishes to make the applications himself, he thus becomes a practical expert, and it becomes now necessary for him to study also the practical field in which he wishes to work. Take the case of advertising. As a psychologist he may be able to analyse the mental factors entering into this work, but there are many more items of a very technical nature, such as a knowledge of printers' types and cuts, of newspaper organization, of articles advertised, of other mediums, and so on, without which he could not become an expert writer of advertisements. On the other hand, the professional writer of advertisements cannot intelligently and successfully employ psychological principles without a fair knowledge of the two branches of the science, because there is no single universal principle that can be applied equally well to all kinds of advertisements, so that in each case he has to make a careful selection and balance of all factors involved. This principle of subjective particularity, as we have called it, holds true of all concrete events involving mental life, and its recognition will prevent many wrong expectations or disappointments with regard to the immediate benefits to be derived from ap-applied psychology.

A FOURTH METHOD OF CHECKING RESULTS IN VOCATIONAL SELECTION

By Walter Dill Scott,
Director Bureau of Salesmanship Research, Carnegie Institute of Technology, Pittsburgh, Pa.

There need be no confusion between vocational guidance and vocational selection. The two are totally distinct in purpose, method of procedure and certainty of results.

The purpose of vocational guidance is to select from all possible vocations that one for which a particular individual is best suited. The purpose of vocational selection is to select for a particular position that one of the applicants who is most likely to succeed in it.

The method of procedure in vocational guidance is to analyze all possible vocations and then to analyze the entire personality of the individual in order that he may be guided into that particular vocation for which he possesses the greatest aptitude or which affords him the greatest possibilities. The method of procedure in vocational selection is to analyze a single vocation, to test applicants as to their fitness for the single function or for the complex of functions involved in this vocation.

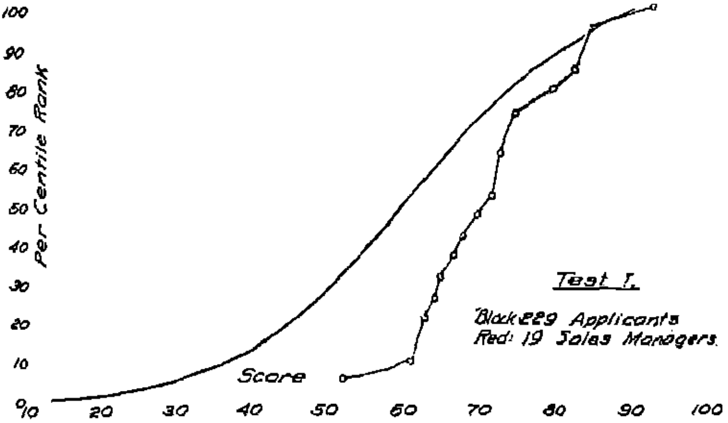
The vocational 'guider' has developed no adequate method of checking the certainty or the wisdom of his advice. If he advises Johnny to become a plumber it is quite possible that another equally wise guider would advise against such action. We know nothing of the agreement between the judgments pronounced by each of a group of experienced advisors all working under the same conditions. If he advise Johnny to become a plumber, Johnny may learn the trade, but succeed only indifferently. Such a failure on Johnny's part can not be construed as conclusive evidence against the wisdom of the guider's advice. If Johnny had entered any other trade or profession his failure might have been more disastrous. Even if Johnny had succeeded as a plumber the wisdom of the advice of his guider would not be conclusive. Johnny might possibly have had a much greater career if he had been directed to dentistry. This unusual difficulty of checking results in vocational guidance has given increased importance to vocational selection as a field for research and for training for those who hope ultimately to advance the cause of vocational guidance.

Before any method of vocational selection is put into practice, its adequacy is easily checked; checks for estimating the value of a series of special tests have been worked out in actual practice. If, for example, the task is to select salesmen for a particular commodity to be sold under recognized conditions, the sales-manager can readily try out the tests in advance by the following method. Let him select from his present force of salesmen working under these conditions ten successful salesmen, ten who are moderately successful and ten who have not been even moderately successful. Let him arrange these thirty in rank order from best to poorest. Let his rank order then be combined with the rankings made independently by two or more executives of the firm who are acquainted with the salesmen and their work. This combined ranking may be spoken of as the Firm Rank, and should agree closely with the rankings of the thirty, secured from the tests, if the tests are dependable. In actual practice a correlation is frequently secured in excess of 75.

A second device for checking the tests is to have experienced men tested with the applicants. If a man has already proved himself successful in a given position and then is tested with applicants for the position, he should make a good showing if the tests are adequate. Correspondingly, the man who has been thoroughly tried in the position and has failed should not be able to make a good showing if he takes the tests with the applicants. Men of known ability appearing with applicants may be called 'Ringers' and are useful in checking the adequacy of the method of giving the tests.

There is a third check on tests that is the most dependable of all, but which is not available until after the tests have been put into operation. This may be called Vocational Accomplishments and consists in comparing the ratings received in the tests with the later accomplishments in the vocation. No man engaged in vocational selection should rest content in giving any tests that are not being constantly approved by this most crucial of all checks.

The three checks mentioned above are all being successfully used, but each offers certain obstacles. It is sometimes difficult to induce executives to provide the Firm Rank. The star Ringer is compelled to masquerade as a novice. The unsuccessful Ringer is frequently unwilling to take the tests. The reports on the Vocational Accomplishments are unavailable for weeks or even for years.


Test I.
Black 229 Applicants
Red: 19 Sales Managers.
Per Centile Rank
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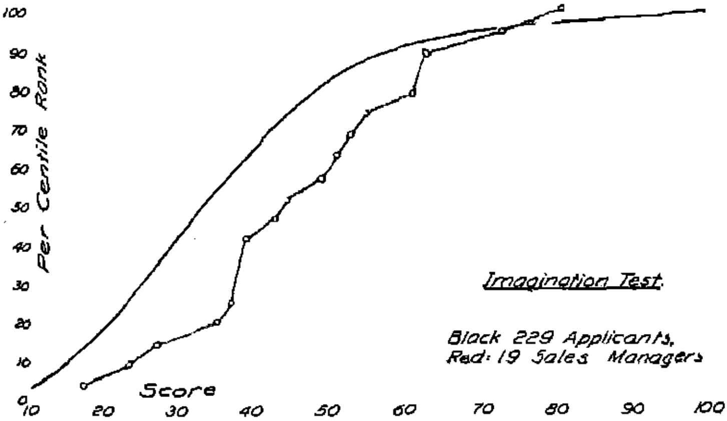
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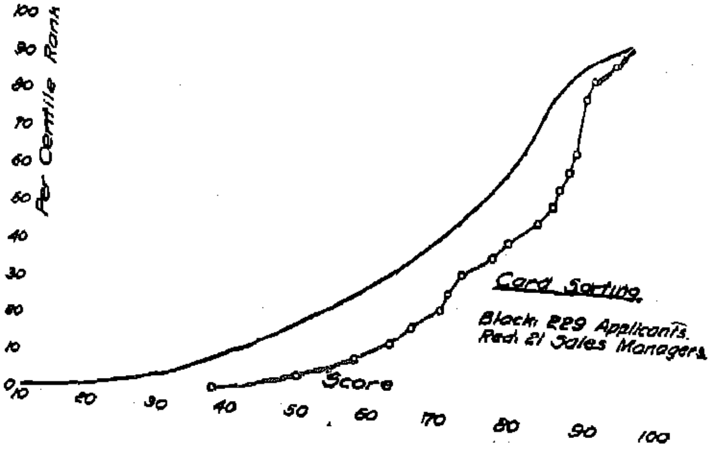
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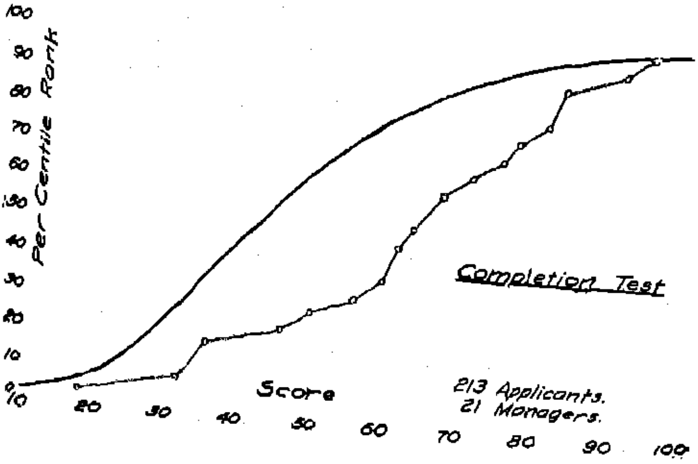
Score
Card Sorting.
Black 229 Applicants.
Red 21 Sales Managers.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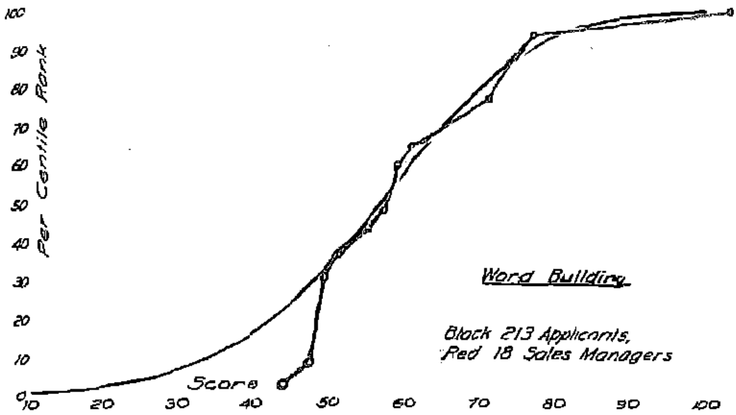
Score
Completion Test
213 Applicants.
21 Managers.



There is a fourth method for checking tests for vocational selection. This method may be designated the Applicants-Experts method. A concrete illustration will make this method clear.

About two hundred and thirty applicants had been recommended for a selling position by the officials of a large selling company. For a period of years about 85 per cent. of all applicants recommended for appointment failed, resigned, or were discharged. It is only fair to assume that these two hundred and thirty men were a typical group, and that 85 per cent. of them, if appointed, would fail. Before appointment the men were all subjected to a series of tests. In the territories where these two hundred and thirty applicants were being tested about twenty 'managers' were induced to take the tests with the applicants. These twenty 'managers' had all succeeded in the task for which the applicants were being sought. The term Applicants as used here refers to that group, 85 per cent, of whom would later fail. The term Experts refers to those who have, at least in a moderate degree, succeeded. The accomplishment of the two groups in the tests is indicated in Charts I to VI. In all the charts the figures on the base line indicate the scores received in the test. The numbers in the vertical column to the left indicate the percentage of the group securing that particular grade or worse. Thus 50 per cent. of the Applicants received in Test I a grade of less than 60; only one of the Experts received a grade of less than 60.

As will be seen at once from a glance at the charts, each of the tests separated the groups fairly well with the single exception of the Word-Building Test.

The conclusions from this fourth check are obvious. The Word-Building Test fails to differentiate the doubtful from the successful group. Unless there is some reason to the contrary it should be dropped from the battery of tests for this company. Test II is too difficult for either group, but still it differentiates the groups. Tests I, III and IV are very satisfactory in differentiating the groups.

Test I is a test of general intelligence, consisting of opposites, mixed relationship, etc. Test II is an unpublished test of imagination of the constructive type. Test III is a modification of Thorndike's card-sorting test. Test IV is a modification of Trabue's completion test. The Word-Building test is the well-known Whipple test. In all instances eight tests were given the applicants. Only the five referred to above were given the 'managers'.

MENTAL HYGIENE AND THE IMPORTANCE OF INVESTIGATING IT *

By Lillien J. Martin, Consulting Psychologist, San Francisco, Cal.

The subject should have been stated on the program as Personal Mental Hygiene and the Importance of Investigating it, to distinguish it from the sociological mental hygiene work which is at present being carried on by the Mental Hygiene Society. By mental hygiene I mean the psychological work to be done in creating, maintaining and restoring normal mental activity in a given individual. There are many reasons why our association should immediately take the lead, set the pace as it were, in this matter of mental hygiene by either appointing a committee to prepare a report for publication in which the different phases of the mental hygiene work could be distributed among its various members in such a way that each subject would be treated by the one best prepared to undertake the work in the particular line, or if it seems undesirable to appoint a committee to prepare a report for publication on mental hygiene until the matter has been taken up and discussed by the association as a whole, would it not be well for the association to set aside at least one of next year's sessions for the considering of this subject.

The three most important reasons why the association ought to investigate the subject of mental hygiene is *first*—the fact that mental testing which should have a therapeutic end in view is nearly everywhere too largely satisfied with diagnostic work; *second*—the fact that there is an almost universal use of some form of mental hygiene and that such use largely lacks the scientific character which it should possess in view of our present psychological knowledge, and *thirdly*—because many of the best physicians would be glad to have the number of their therapeutic methods increased. In considering the opening of an office as consulting psychologist I had an experience recently which shows the desirability of our association taking the initiative in the mental treatment of disease by publishing something in the way of a preliminary report. I visited some thirty of the leading physicians of San Francisco to inquire whether they thought there was any opportunity for work there along the line of personal mental hygiene. With one exception, where the physician was doubtful they replied "yes". A few physicians went so far as to say that mental hygiene was the next step in medicine and two of them actually offered me an office without any expense to myself. The fact is, the physicians are coming to realize that they have neither the time nor the knowledge to make proper use themselves of mental hygiene in their practice, and if they do not see to it that it is taken up by persons prepared to undertake it scientifically it will be attempted by those not properly equipped.

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* Presented at the New York Meeting of the American Psychological Association, Dec., 1916.

The investigating and applying of mental hygiene looks in many directions:

1st: To the methods and the psychological material to be used in teaching it to freshmen and other students in colleges and universities who are entirely ignorant of the laws governing mental action and indeed scarcely aware that people possess minds. An examination of the curriculum of the various American universities and colleges will show that while lectures are everywhere given in physical hygiene scarcely ever is mental hygiene taken up in a place which has largely to do with the activity of the human mind. That mental hygiene is not given in the lectures on general psychology is shown by examining the content of the various psychological text books published by college professors. Such silence in regard to mental hygiene cannot be attributed to psychological ignorance, for we have already collected a large number of laws regarding memory, attention, imitation, suggestion, habit, fatigue, etc., which would greatly help the student to understand and improve his own mental and physical activity. Of course, such a psychological discussion as the one proposed is bound to bring up old and unsettled questions—that of transfer of practice is one that immediately suggests itself. What we do need to do is to get together our psychological knowledge and decide what would be most valuable to present in the way of intellectual and emotional guidance not alone to the college student but to all persons desiring to improve and develop their ability to think correctly. That is, it seems to me that in view of the silence of psychological text books in general regarding mental hygiene this association should now collect and summarize in printed form such material as is now available in the form of syllabi and other unpublished writings whereby psychologists may, so to speak, pool their knowledge along this line in order that students may have presented in lectures on mental hygiene that which will be most useful to them in their subsequent university work and in later life. Such a report might also be made very useful to the teacher of psychology in meeting the needs of those outside the university who inquire of him as to the best methods of improving the memory, training the attention, etc., for aid in controlling and strengthening the intellectual life.

2nd. To the making of a curtailed summary and a critical study of the work that has been done by psychologists and others in applying mental hygiene to the preventing and removing of mental and physical weakness and disease, and to an expression of opinion regarding the general value of the various remedial mental methods employed.

3rd. To a brief presentation of investigations along psychological and physiological lines which have a significance from the standpoint of mental hygiene although not directly concerned with it. From the standpoint of physiology the interesting work along this line of one of our members, Dr. Cannon, immediately occurs to one as a contribution to this subject. Even psychological work which at first thought seems to offer little that would be of mental hygiene value I suspect will be very suggestive when one examines it closely from the point of view of mental hygiene. Experiments with weights which have been sometimes considered laborious and even tedious at once occur to me as offering material useful from a mental hygiene standpoint.

4th. To the gathering of suggestions from physicians having a psychological turn of mind who are working in other medical departments as well as that of psychiatry as to the particular fields of mental hygiene which their experience suggests as the most desirable and promising for investigation. There are, of course, certain fields as that of adolescence and senility the importance of investigating which will be evident to those having no special medical training.

5th. To the examination of the present statute laws in the various States governing the diagnosis and treatment of mental and physical disease which should be made to ascertain whether a modification of old laws is not needed and whether some new laws should not be introduced to aid in the putting of mental hygiene on a more scientific and satisfactory basis. The question at issue is really whether the work of the psychologist in mental hygiene is to be one of working entirely under a physician or whether his opinion on the data obtained is to be regarded as final, whether, as in the case of the chemist who makes the urine analysis, or the physicist who makes an X-ray examination, the data are to be submitted to the regular physician often possessing little or no psychological training, for final examination and decision.

Other matters needing consideration will doubtless occur to you which should be discussed in a report on mental hygiene or taken up in a discussion at a session of the association set apart for this purpose. In conclusion I will say, that I shall bring up this matter at the business meeting tonight and I very much hope that others will think also that our association should not longer ignore the thorough consideration of personal mental hygiene.

A COMPARATIVE STUDY OF WHITE AND NEGRO CHILDREN[1]

By DAGNY SUNNE, Ph.D.

As New Orleans offers unusual opportunity for comparative study, an investigation was begun last year to compare white and negro children of nearly similar social and economic status by means of the Binet and Yerkes Point Scales and other tests. All the white children above grade II in a school situated in one of the very poorest districts were selected for examination in order to have environmental and school conditions as nearly similar as possible to those of negro children of corresponding age and grade. It was hoped that the results would indicate whether the ordinary school program is as well adapted to the negro children as to the white. The purpose was not so much to get a general intelligence quotient, as to find out specific points of similarity and difference. The children, white and negro, attend public schools in the same district. The white children were tested first and then an almost equal number of negro children of as nearly the same age and grade as possible. Each child was examined individually by the investigator. The superintendent, principals and teachers cooperated heartily in the investigation, and the children, who assumed that it was merely a new kind of school exercise, were eager for the tests and seemed to do their best. Both principals and teachers were unaware that the tests were made for a comparative purpose. No children below the second grade were examined as it was desired to employ other tests that required the ability to write and to use colored crayons. The white children are mainly of Irish, German, Italian and French ancestry, but all are natives of New Orleans. In only two families is a foreign tongue used to any extent in the home, and few of the children can understand even a word of the language of their parents. Consequently all of these boys and girls may be considered English-speaking children. The white children tested by both scales numbered 112, 47 girls and 65 boys, from grades II to V inclusive; 116 negro children of corresponding grades, 54 girls and 62 boys, besides 8 girls and 2 boys of the VI and VII grades, 126 in all. Thus 238 children were examined under exactly similar conditions.

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[1] From the Callender Laboratory of Psychology and Education, Newcomb College, New Orleans, La.

According to school grades, the negro children are more retarded than the white as regards both gross percentage and amount, the differences being 10% and .2 year. However, the percentage of retardation is the same for both groups in grade II, and a little less for the negro than for the white in grade V. The negro girls get higher averages than the white boys. By the Point Scale ages the gross percentages are the same, but the averages of the amounts vary by .1 year. The retardation of the negro children is less in percentage than that of the white in grades II and V, and less in amount in grade II.

Reckoned by Binet ages the percentage of retardation of the negro children is greater than that of the white children, though the average amount is the same for both. At 11 the negro percentage is a little less, and at 8 the two groups are about even. The percentage of retardation is greater for both groups by the Point Scale though the difference between them is about the same by the two scales, the negroes being the more retarded. The difference in amount is a little more than .1 year in favor of the white children. As to percentage of retardation at different age levels, that of the negroes is less at 8, 11, 12, 14 and 15, and the two groups are even at 13.

The differences between the boys and girls both white and black are somewhat variable. The white girls in every grade average higher according to both scales than do the boys. The same is in general true for the negro girls. In grade IV the latter rank lower than the boys according to the Binet Scale, and their amount of retardation increases in the higher grades more than it does in the case of the boys. The white girls surpass the boys in all their averages at every age according to the Point Scale scores and ages, but the average of their Binet ages is lower at 8, 9, and 12. The general averages of the negro girls according to chronological ages are higher than those of the negro boys, but the averages of their Point Scale scores and ages are lower at 9 and 14 and their Binet averages are lower at 9 and 13 than those of the negro boys. There is, consequently, some indication of a difference in mental development between boys and girls at the 8-9 year level and at early adolescence.

In order to compare racial and sex differences, the white children were grouped into a lowest 25%, a highest 25% and the medium 50% according to their scores by the two scales, and the percentage of negro children between the same limits was found. The percentage of negro children in the lowest group is greater than that of the white, but also the percentage in the highest group. According to this grouping the sex difference between the white boys and the white girls, and between the negro boys and the negro girls is greater according to per cents of the Point Scale scores than the corresponding race differences, but according to the Binet ages and the Point Scale ages, the race differences in the two highest groups are greater than the sex differences. If these children are compared as to amount of their scores according to the different scales the sex differences between the white children according to Point Scale ages are greater than race differences at chronological ages 10, 11, 12, and 13, and similarly the sex differences of the negro children at 8, 9, 10, 11 and 12. According to Point Scale scores the sex differences of the white boys and girls are greater than race differences only at 13, but the sex differences of the negro at 8, 9, 11 and 12. Only at 10 and 13 according to the Binet ages do the white boys differ more from the girls than each sex does from the corresponding negro boys or girls, and the negro boys and girls at 11 and 12 differ more widely from each other than they do from the white children, that is, the racial differences in amount of Binet scores are greater than the difference between the boys and girls of each race. These comparisons show the great variability of racial and sex differences at the different age levels, and also that the amount of this variability depends on the scale used. On the whole, the negro boys and girls differ more from each other than do the white boys and girls, and the scores seeem to indicate some definite racial differences, which become more apparent when the rating of the children in each test is considered.

According to the Point Scale the negro children are inferior to the white in exercises 3, 5, 8, 11, 15, and 20, though the averages conceal the fact that the negro boys do slightly better than the white boys in tests 5 and 8. The same facts are brought out by the Binet Scale only in part, as the scores show the negro children inferior in tests V. 1, XII. 4, and VIII. 2, equal to the white children in tests IV. 4, and IX. 5, and decidedly superior in test X. 4. The differences between the children and divergences of the scores according to the two scales are both significant. Their rating in Point Scale 3 and Binet XII. 4 and IV. 4, shows that the negro children can distinguish the longer and shorter of pairs of lines as accurately as the white children, but when the six pairs of lines are arranged so as to test suggestibility they will yield to the suggestion much more readily. In the test of arranging weights (Point Scale 8, Binet IX. 5) the scores of the white children are higher according to the Point Scale but equal to those of the negro children by the Binet Scale, a variance that shows a preponderance of higher scores on the part of the former. As this exercise tests motor adaptation and accuracy of judgment in manipulating things, the negro boys and girls may be inferior in both. So far the investigation has disclosed no definite difference between the two groups in methods of handling the weights, so that it seems that the lower scores are due chiefly to deficiency in accurate motor discrimination. In the comprehension test, the negro children do better than the white according to Binet scoring (X. 4) but less well according to the Point Scale (15), due to the greater frequency of the less comprehensive and intelligent answers. The examiner received the impression from these answers of the negro children that kindness and forgiveness and the avoidance of bad words had been drilled into them as general principles, so that they replied as they felt they "ought" rather than as they would act. Such an attitude was not prominent among the white children except in a few special instances and in the problem of action versus words. In the white school the use of offensive language had to be strenuously discouraged. Hence judging character by the language used loomed large before the white children as well as the negro children. Both groups of children did poorly in completing the analogies (Point Scale 20). From the white children 61 correct answers were obtained for one analogy (almost invariably a), 26 correct answers for two analogies, six for three and three for four analogies. The corresponding results for the negro children were 58, 17, 12 and 5, or 54% of the white children were able to give 1 correct answer, 23% gave 2 correct answers, 5% gave 3 correct answers and 2.5% gave 4 correct, as compared with 46%, 12.5%, 10% and 4% for the negro children between 8 and 15 years of age. Perhaps such results indicate slightly less general intelligence on the part of the younger negro children than the white. Four correct replies were given by 2 thirteen-year-old white girls, and 1 fifteen-year-old boy, and in the case of the negro children by an eleven-year-old girl, 2 girls and 1 boy fourteen years of age, and by a fifteen-year-old girl. Analogy (a) proved to be the easiest and (e) the most difficult.

In memory tests, according to the Binet Scale, the white boys do best in VIII. 5 (repeating 5 digits), and the white girls in IX. 3 (giving date); the negro children a little better in the other tests except VIII. 3 (giving days of week) in which both groups get the same averages. The general averages according to the Yerkes Point Scale are a little higher for the negro than for the white children, but as in the case of the Binet Scale the scores for the different age levels are very variable. The negro children average higher in the tests requiring immediate retention of words than in retaining numerals. Their scores for memory span of digits (Point Scale 4) show fewer scores of 5 both relatively and absolutely than do those of the white children, but they have more scores of 4 in this test.

On the other hand, the negro children do better than the white children in describing and interpreting pictures, in giving words for three minutes, in constructing and re-constructing sentences and in defining abstract terms. How much better many of the negro children succeed in describing pictures and in giving words for three minutes is not brought out clearly in the scores. They described the pictures with greater detail and understanding than the white children, so that it was often difficult to decide between description and interpretation, and in such cases the error in marking tends toward a lower rather than a higher scoring, in order to avoid giving undue credit to ease in use of words and to imaginative responses without the deeper comprehension. The free-association test called forth a much greater number and variety of words among the negro than among the white children. The latter in the majority of cases confined themselves to objects in the room or immediate surroundings, the former drew freely from all sorts of experiences. The other tests in which they do better also involve the use of words, or the appreciation of form as in drawing a square, a diamond, and designs from memory. This group of negro children, then, do worse than the white children in work that demands finer sensory discrimination and resistance to immediate impression such as the tests in estimating lines and weights, and in some forms of reasoning, but they do better in tests demanding verbal analysis and facility and constructive imagination.

There are some tests in which the negro boys do better than the white boys, but the negro girls worse than the white girls, namely, in tests 5, 9, 10, 17, 19 of the Yerkes Scale. The averages for these tests show that the girls and boys of each race are very nearly alike, the averages being somewhat in favor of the girls both white and negro. Thus the apparent anomaly must be due to the mental superiority of some of the white girls. The scores of the boys as distinct from those of the girls in the Binet tests show few differences of any considerable amount. The white girls do better than the boys in defining concrete and abstract words, giving date and naming months and the boys do better in the game of patience, in repeating numerals and drawing designs from memory, which results perhaps indicate better permanent retention of details on the part of these girls and better immediate discrimination and memory on the part of these white boys. The negro girls surpass the negro boys in arranging weights and constructing sentences and the boys in the game of patience, copying the diamond, drawing designs from memory and counting stamps. Thus these negro girls do better in kinaesthetic discrimination and verbal analysis and the boys in visual discrimination and motor co-ordination.

Some interesting facts result from a study of the scores of the white and the negro children in the tests used by Binet and which were not adopted by Yerkes. In test V.5, the negro children made many more failures than the white children, and the girls are worse than the boys. When this test was given the number of moves made by each child was recorded. The white girls who succeeded in the test averaged 5 moves, the successful boys 3 moves, while those who failed averaged 10 moves for the boys and 11 for the girls. The successful negro children made an average of 3 moves each; the unsuccessful boys averaged 6.5 moves each and the girls 5. In this test the individual negro was not slower than the white child, but as many more failed, their average reaction time is higher than that of the white. No negro child made as many attempts as some of the white children. Several of the children both white and black arranged the triangles correctly but did not notice it, and continued trying different arrangements. All the white boys who failed were over 3 years retarded except one boy, almost 3 years retarded, who made 24 attempts. The white girls who failed were about evenly divided between the worst and the best according to their scale scores. The negro children showed a similar tendency, though a few boys with comparatively high mental age averages failed. One 11 year old negro boy about 2 years retarded made 22 moves, the largest number. Some of the most retarded children, both white and black, were satisfied with an incorrect arrangement of the triangles.

In the Binet tests of executing three commissions, distinguishing between right and left and recognizing all the pieces of money, the black and white children are about even, but in making change the negro children are inferior, but superior in naming the date and the months and giving rhymes. Not a single child solved completely the problem of reversing the clock hands, though a small number, about the same percentage of each race, gave correct answer to half of the test. The difficulty may have been not so much lack of ability to control visual imagery as lack of acquaintance with timepieces. This test and the problem questions were the most unsatisfactory tests for these children. One negro girl alone gave the answer required by Binet for the first problem, but 4 white boys and 1 girl suggested a corpse or a man hanging. All of these children readily gave answers to (b) such as sickness, death, fighting and killing, but few gave a complete explanation for the presence of the three officials, and these few failed in problem (a). To the latter problem the answers of the negro children were more varied and specific, and fewer of them answered leaf, moss, or branch than did the white children. The negro children, both boys and girls, did a little better with the code test than the white children.

The designs drawn from memory were often extremely fanciful, many queer additions or changes being made, so that the copies were entirely different from the originals. No difference in difficulty between the two designs could be inferred from the results. Here the white children seemed to draw as freely on their imagination as the negro, as they contributed 28 and the negro 25 of these peculiar drawings. These designs were about evenly divided among the white boys and girls as well as among the more and the less retarded. As regards the negro children, all the most retarded of those above 12 years of age, and almost the same number of the more and the less retarded among the younger children produced some bizarre designs.

In connection with the Binet tests the scores for opposites were obtained for the negro children. When the white children were tested 3 failures were deemed sufficient to make further work with that test unnecessary, except with the fifth grade children who were given the test in full. All of the negro children were given all 20 words, no matter how many failures or mistakes were made. Thus a complete comparison between the two groups is not possible. As far as they are comparable, the negro boys do better at every age than the white boys, while the white girls are superior to the negro girls only at 11 and 13. The white children are below Pyle's norms except the 11 year-old white girls. The negro boys are below these norms except at the ages of 9, and 10, and the negro girls also except at the ages of 8, 9, and 10. The scores are probably not fairly comparable with Pyle's norms as the tests were administered differently, but the scores seem at least to indicate that these children are inferior to the children tested by Pyle. On the whole, the Opposites test also appears to be one involving the use of words in which this group of negro children is superior to the white children tested.

In addition to the individual testing of each child by means of the Binet and the Point Scales, three different class tests were given under the direction and supervision of the investigator. As these tests involved reading and giving of directions that had to be comprehended by the whole room full of children, it seemed better that the class-room teacher do the actual talking in order to avoid any possible misunderstanding from a difference in pronounciation.

The first of these tests was the so-called logical memory test, The Marble Statue. The story was read to the children and they reproduced it, being given all necessary time for writing what they recalled. The directions given by Pyle[3] were followed exactly and the results compared with his norms. According to the averages in this test, the negro children seemed on the whole inferior to the white, whether classified according to sex, age or grade, with the exception of the fourth grade, where the white boys had lower scores than the negroes. The same inference must be made from a comparison of these scores with Pyle's norms. Though the white children in general average below these norms, the negro children are still lower as can be seen from the average deviations, —.49 for white boys, —.61 for white girls, as compared with — 1.04 and — 1.45 for the negro boys and girls respectively. If five records which are less than half the average scores and which are made by retarded children are excluded, the average deviation from Pyle's norms will be — .36 for 41 white boys, — .7 for 41 negro boys and — 1.22 for 28 negro girls, while the white girls exceed Pyle's average by .18.

As the reproduction of this story may be to a great extent verbatim repetition and at the best is a measure of the ability to retain and organize ideas logically, it seemed that interesting differences might be brought out by giving the children an opportunity to let their fancies roam freely. The beginning of the story suggested by G. M. Stratton in the "Atlantic Monthly" February, 1916, p. 212 in his article, "Girls, Boys and Story-Telling," was used. This was read to the children by the teachers who asked their pupils to finish it as well as they could. The compositions resulting have been entitled "The Princess" and marked according to the number of ideas added by the children to complete the story. The superiority of the negro children of corresponding grades and ages over the white children is almost startling. The general average for the white boys is 3.4 (M. V., 1.3), for the white girls 4.8 (M. V., 2.2), for the negro boys 10.8 (M. V., 3.9) or 12 if two greatly retarded boys are disregarded, and for the negro girls 12.6 (M. V., 3.4) while only one white girl surpasses the average of the negro girls and not a single white boy reaches the average of the negro boys. The fifth grade average for the white children is 5 as against 11.3 for the negro. The fact that the negro children are somewhat older cannot be the sole explanation of this difference, as both white and negro boys do best at 11 and the girls at 13.

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[3] Pyle, W. H.: Examination of School Children, pp. 9-10.

The correlation between the Marble Statue and the Princess gives the following coefficients: For the white boys grade III., r = .22, grade IV., r = .32, grade V., r = .48; and for the girls grade III., r = .37, grade IV., r = .01, grade V., r= —.42 For the negro children the coefficients are for the V., grade boys — .38, and for the girls r = 0, for the VI. and VII. grade boys r = —1., and for the girls — .94, and for both boys and girls r = — .96. These divergences in correlation suggest some difference in the mental processes of these children when confronted with such a test as completing a story. For most of the white children it is apparently a matter-of-fact task, a perfunctory duty; for many of the negro children it becomes a delightful chance to call forth memories and fancies, though the former have much better opportunity to see pictures and read stories.

Color preferences of negroes are often supposed to be distinctly different from those of white people. In order to investigate this assumed difference and also to test their aesthetic judgment in this field, each child was given the box of eight colored crayons used in their drawing work and outlines on rag-paper of a little girl holding over her shoulders a long cloak or train which falls on the floor behind her. Although such a figure would be familiar to all, it also would be out of the ordinary so as to stimulate inventiveness. Recollections of carnival costumes might also show their influence.

Classifying these colored drawings first by the color of the dress, as being the most prominent feature, we find that of 78 negro children the boys show a decided preference for blue with yellow a distinct second, while the girls also put blue first with orange a much closer second. No boy chose green for the dress while among the girls green and red tied for the fourth place. For the color of the cloak, the negro boys make red first, orange second choice; the girls blue first choice, yellow second, and red a close third. The white boys select blue and red as first and second choice for the dress; the girls show a decided liking for red, while blue is second in rank. No definite preference is shown for any one color in the cloak; the boys choose red and yellow, and the girls yellow and blue most frequently.

The color used most often by both white and negro children is black. The order of frequency for the white children, black, yellow, red, brown, blue, orange, green, purple, as compared with that of the negro children, black, yellow, brown, orange, red, blue, green, purple, shows that red is chosen more often by the white than by the negro, by boys rather than by girls, and that green and purple are at the end of the scale of preference, while orange stands much higher among the negro than among the white children. Thus the liking for bright colors seems in this case to be no stronger among the negro than among the white children. It is also surprising that the children often used faint colors rather than the stronger hues, and that the negro children especially combined a faint and a heavy tone of the same color. It may be of interest to note that the order of preference for the color of the hair is for the white children, black, brown, yellow; for the negro, brown, yellow, black. Some college girls in the Art Department who colored the same drawings chose blue, orange, green and yellow, or combinations of these for the dress, did not use black at all, and made the hair yellow or auburn.

The colored drawings of these 167 children were submitted to two art teachers for judgment and classified as excellent, good and poor. One of them judged the drawings just as similar work of college art students would be estimated, according to accuracy and correct relations of color values, the other placed more stress on color tones and inventiveness. The former will be termed the A, the latter the B classification. According to the A judgments 9% of the colored drawings of the white children were excellent, 29% good and 61% poor, and only 18% of those of the negro children were good and the rest poor. According to the B verdict, 17% of the work of the white children was excellent, 44% good, and 39% poor, as compared with 23%, 33% and 43% for the negro children. In the case of the latter the B judgments place the majority of the children whose chronological ages, Binet mental ages, and Yerkes Point scores are highest among those who do best in coloring, while the A judgments class the children whose scores are medium as good in coloring the outlines. For the white children the two sets of judgments agree much better as to chronological age and Binet standing, but show some divergence in relation to the Yerkes scores, more of those whose scores fall between 40 and 60 being considered good by B than by A. Fewer of the children, both white and negro, of the upper grades are put in the poor class by B than by A. It seems from these facts that the use of colors by the negro children is more primitive, but also capable of development along new lines. To the investigator the poorer work of the two groups seems very similar, though none of that done by the negro children is quite so crude as that done by a few of the white girls and boys, while the better work shows more daring and striking combinations than any tried by the white children.

More of the colored drawings of the white boys than of the girls were judged excellent by both A and B, though a greater number of girls than of boys were put in the "good" class by B. The work of the girls was considered decidedly poorer by A, 54% of the boys as against 72% of the girls being put in the lowest class, while in the B list 40% of each sex are found in the poor class. The negro girls were considered somewhat better than the boys by A (21% as against 15%) while a greater number of boys than of girls were put in the "excellent" and "good" group by B.

An attempt was made to correlate this work in coloring with the story of "The Princess". Here the B judgments show somewhat better postive correlations with the story than do the A judgments as regards negro girls, while in the case of the negro boys, the A judgments are in inverse correlation with the upper 50% and very close correlation with the lower 50%, while the B judgments sustain exactly the opposite relations. Too few subjects were tested to draw any conclusion.

A comparison of these results with the findings of other investigations shows both similarities and differences. The conclusion drawn by A. C. Strong[8] that "colored children are mentally younger than the white children of corresponding ages" is true of these children also if measured by the Binet Scale, but not according to the Point Scale. That "the colored children test more irregularly than the white children" is partly corroborated by this investigation, but the conclusion that "according to the Binet Scale a larger number of white children are in a grade below their mental ability rather than above, and the reverse is true of the colored children" does not hold of these children. As to the difficulty of individual Binet tests the results are in harmony as regards the difficulty of IX. 2 and 5, X. 2 and 4, XI. 5 and XII. 3, 4, 5, and the ease of VIII. 1, 3, and 5, and X. 1. But VIII. 4 and X. 5 proved harder for the white children than for the negro, and

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[8] Strong, A. C.: Three hundred and fifty white and colored children tested by the Binet Scale. *Ped. Sem.*, 1913, 20:485-515.

XII. 1 and 2 hard for both. Not any child examined gave both answers required by Binet for XII. 5, though some reasonable answers were given by both groups.

The observation of Phillips[4] that "the colored pupils as a class were good in the memory tests and poor in those requiring judgments" coincides only in part with the results of these tests. That they "were generally slower in response" was true as regards some of those who were more retarded, but not of the group as a whole. In fact their reaction time seemed less in exercises that test verbal associations and analysis. Mr. Phillips found the negro children "less animated." No such difference could be noted between these children.

The results of the measurements of these two New Orleans groups are in substantial agreement with those of Miss Perring[5] that the negro children on the whole are older and have apparently fewer physical defects than the white children, and that they are more retarded, only the retardation is greater in amount in the case of these children than was found in the Philadelphia School.

As the tests reported by Ferguson[6] were entirely different from those tried on the New Orleans children no comparison is possible. As regards the variance in ability between the full-blood and mixed-blood, the writer ventures no conclusion, as too few of the former were tested.

As far as comparable, the results of this investigation agree on the whole with those reported by Pyle[7]: that the racial differences are variable, that the negro girls surpass the boys more than the white girls surpass the white boys (if the averages alone are considered), and that negro children are inferior in motor-co-ordination.

SUMMARY

1. Specific differences between these white children and negro children seem to be mainly a greater facility in control of words, a more fertile imagination as relating to general human activities, though not in problems demanding mechanical preciseness and ingenuity, and a more original and perhaps more primitive taste in use of colors, on the part of the latter;

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[4] Phillips, B. A.: The Binet Tests Applied to Colored Children. *Psychol. Clinic*, 1914, 8: 190-196.

[5] Perring, L. F.: A Study of Comparative Retardation. *Psychol. Clinic*, 1915, 9: 87-93.

[6] Ferguson, G. O., Jr.: Psychology of the Negro. *Archiv. of Psychol.*, No. 36, 1916. pp. 138.

[7] Pyle, W. H.: The Mind of the Negro Child. *School and Society*, 1915, 1: 357-360.

greater resistance to suggestion, better kinaesthetic discrimnination and motor control, and perhaps a better capacity for logical analysis on the part of the white children. The tests in reasoning on the whole show no definite race differences. Contrary to a prevalent notion, these negro children were not superior to the white in verbatim reproduction or immediate retention, and about equal to them in tests of permanent retention. A greater variety of details was noted by the negro children in the Binet pictures, so that in this respect their capacity for observation is keen. In work requiring constructive imagination, as shown in story telling, they were far superior to the white children tested. The test used to get a clue to differences in color preferences did not show a more decided choice of the brighter and more saturated colors by the negro than by the white children. The variance in reaction of the white and of the negro children to the test in finding rhymes made this also one of the more significant exercises, as complete failure in giving rhymes was very rare among the black, but rather frequent among the white children.

2. The variability of the scores of these children may be due to race differences, sex differences, or variations in individual capacities. If all the results are considered, the influence of the latter factor is probably as great as either of the others.

3. The educational bearings of the results of these tests may be significant if corroborated by more extensive investigations. They indicate on the part of the greater number of these negro children a keener sense of rhyme, an unusual facility in story-telling and originality in color combinations. For example, in their stories suggested by the Binet pictures and their compositions on "The Princess" many of them showed an artistic development very different from any manifested by the white children. On the other hand, in exercises that test abilities most commonly demanded in our public schools, the majority of the black children reach the average of white children markedly retarded both according to school grades and mental tests, though some of them exceed it. But if there are certain traits in which they differ conspicuously from the white children it would seem advisable to encourage and train these peculiar tendencies as well as more general capacities instead of exclusively trying to fit them into the pattern that suits a majority of the white children. Educational progress may be achieved both by conforming to high standards and by individual variations.

SIDETRACKING OF STUTTERING BY " STARTERS "

WALTER B. SWIFT, M. D., Boston, Mass.
Miss JENNIE HEDRICK, Washington, D. C.

The object of this paper is to collect from patients methods and means used by stutterers to start their own speech.

The so-called " starter " is not a symptom or sign of stuttering. It is not always present in uniform shape; but varies according to the ingenuity of the patient and according to the methods he happened to stumble upon. As it is not a symptom or part of the disease itself, a definition is therefore apropos under such circumstances.

A "starter" consists in any sort of a makeshift, start, action or attitude that a stutterer consciously or unconsciously invents in order to facilitate the flow of language. More detail can hardly be taken without encroaching upon the main part of the paper. Perhaps one illustration will suffice to clarify this definition. For example, a stutterer comes to me and tries to say " Good-morning, Teacher," but the "g" sticks in his throat and he is unable to utter it till he moves both elbows outward. This he claims starts his speech somewhat better than without it. To the external observer he is able to utter the " g " in " good " and the word " teacher " runs off easily itself afterwards.

The patient has consciously invented this speech helper and consciously employs it to start his speech and finally it may become an unconscious motion.

A word about what the "starter" is not. The starter is not a cure. The starter is not something that has been told the patient by another; otherwise it would be a method of cure or at least a method of relief. Starters are not the same in their form. Finally they are not any part of the disease whatever. A starter is not tic; and not chorea.

With this, I think it will be clear just what a starter is and what it is not. Let us proceed then to describe what they stand for and do when used by patients.

The principle of starters is simple and always the same. The sole and only reason for employing a starter is for the obvious reason of diverting the attention from the throat contraction and throat spasm and the accompanying mental strain that prevents utterance.

We come next to the forms and varieties of "Starters." Out of our entire list of stuttering patients, 123 cases, we have tabulated the various forms and shapes of starters that were used by some of these patients. The varieties of starters consist of the following:

Of 123 patients 45 have starters.
Of these
1 was arm motion.
2 were leg motion.
1 was body motion.
9 were hand motion.
8 were head motion.
7 were parts of face.

A complete list of all these starters follows:

Taps with little finger and bobs head up and down.
Occasional repetition of syllables.
Speech accompanied by excessively stiff and open jaws.
Frequent inhalations.
Deep inhalations.
Laugh.
The word "For."
Marked contortions consisting of throwing the head to one side with strained and forced open mouth, contraction of neck muscles which spread to the back, arms and sometimes legs; also frequently long closing of eyes.
Speaks slowly and clasps hands.
Hand and leg motion.
Whisper.
Click of the tongue.
Laughs, blows and wobbles her head about; also says, "Let me see."
Raises leg or arm.
Closing fist and moving hand as in pounding.
Says a short sentence three or four times under his breath.
Also repeats a vowel or consonant over five to six times, then utters his sentence.
Holds breath before starting a sentence and says, "See-see-see."
Rapidity in utterance 2 cases.
"Breathing and thinking ahead what he had to say."
Tapping and talking slowly, gasps and throws back his head with deep inspiration.
Bobs head up and down as if saying yes and no in rapid succession.
"S" as a starter.

Gasps frequent and severe.

Hard jerk and jaw drops.

"I wait and then I can say it."

Crossed fingers behind her back, flaps her hands to side; also stamps feet three or four times before beginning to talk.

Pounds hand or fist on knee, table or chair.

Twists or puckers her mouth.

Puts hands together and opens and closes them like a shell.

Breathing 2 cases.

Inhalation 3 cases.

High note as a starter; also repeats initial syllable. Sometimes strikes three or four high notes, going higher and higher till this works as a starter.

Helps himself by stopping and thinking.

Stops and starts all over again.

Movement of head to right and left.

Bows his head and holds it down and tries to blow out his words.

Moves her hands and sometimes takes a deep breath.

Holds mouth open in hesitation before speaking.

Motion of body.

Breathes to start his talk.

We come now to a consideration of the psychological analysis of some of these cases.

By this is meant an introspection of the patient himself before starting the starter, the effect of that starter, and the comparison of his speech with or without that "starter."

This can be shown by presentation of the following case analyzed in the way mentioned above.

That is, the psychological side can be easily seen by a report of some introspections by patients as follows:

Puts hands together and opens and closes the fingers like a shell.

The instant trouble is anticipated the patient tries for slowness of speech as a "starter" and secures it through the hand motion. The slowness partly diverts his attention, but it doesn't cure—that is, he has the same trouble the next time on the same word. Help is merely for that occasion.

Pounds knee, table or chair with fist.

The starter is used when the patient stutters very hard. Boy says, "When the stutter comes back" he applies the starter in the middle of a hard stutter. Boy says, "Helps to make stutter go away." Pounds with right hand mostly but sometimes both together, to "make stutter stop." Patient can not introspect very well. He says the sentence goes along easily after "the hit." After stutter is relieved by activity, the following words are easier. After suggestion he says that he anticipates trouble and uses the "starter" to sidetrack the stutter, but usually uses it after the stutter has begun.

Twitch of mouth.

Pucker of mouth.

"Starter" consists of puckering her lips to help speech along. She uses it at the beginning of a stutter.

It is used pretty constantly, yet on some days when stutter is not so bad it is not used so much.

She sees trouble coming ahead on certain words. When the stutter is to be severe she uses the "starter," which is left out when little trouble is anticipated.

Help is momentary. Just as much trouble on same words next time.

To summarize these psychological activities, we would say that the data in these few cases of introspection show:

First: That "starters" originate as entirely conscious matters. After long use they may become almost unconscious but not quite so, although they are held to be so by the patient.

Second: That they are used just after trouble is anticipated and mostly when severe trouble is anticipated. In other words the patient sees trouble coming, then consciously inserts the "starter" to sidetrack it.

Third: "Starters" are entirely a matter of volition and may be inserted or omitted at the will of the patient.

We next come to the explanation of the inefficiency of starters. They fail to cure. They fail to relieve more than temporarily. They only relieve for the instant. It is up to us now to give the psychological reasons for this inefficiency.

The reason is because a "starter" is merely a temporary diversion of the attention.

Completion of the treatment of stuttering is made through and comes from the development of the visualization process.[1] A momentary sidetracking of the attention can hardly ever attain to the dignity of developing such processes whence comes its inefficiency as treatment.

Summary: To recapitulate, a "starter" consists in any invented motion or action gotten up by the patient to help his speech action. From analyses these are shown to be movements of head, arms, body, face. To the variety of 41 in 45 cases out of 123 cases examined, they are merely instant helps. They are no cure. They are usually different in different patients. They are usually the same in the same patient. Their momentary efficiency consists merely in a diversion of the attention. Their failure to cure consists in the lack of any profound development of visualization processes.

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[1] Swift, Walter B.: "The Developmental Psychology of Stuttering." *Journal of Abnormal Psychology,* Oct.-Nov., 1916.

BOOK REVIEWS

H. L. HOLLINGWORTH, *Vocational Psychology, Its Problems and Methods.* D. Appleton & Co., 1916, pp. xviii, 308.

As a result of the tremendous increase in industry and in the varieties of occupations during the nineteenth century, we at present must face the important problem of fitting the right man to the right occupation. This is obviously as important for the employed as it is for the employer. Some systematic and scientific attempts have been made to work out methods for indicating the aptitude of an individual for certain lines of endeavor. Such an attempt, the author points out, resolves itself essentially into a study of individual differences, differences largely in the mental characteristics of both the occupation and of the individual. Although this branch of applied psychology is still in its infancy, a sufficient body of carefully acquired facts has already been determined to warrant the designation of Vocational Psychology. Hollingworth frequently emphasizes the fact that this new science is still incomplete and that, at the present time, it is by no means capable of giving the proper vocational guidance to the individual case. The present volume is an attempt to determine definitely the problems which the new science must attempt to solve, to summarize the present existing methods and the body of fact already acquired, and finally to evaluate the methods and to point out which of them appear to be the more fruitful. Hence we have here an attempt to work out a systematic program for work in the future.

Hollingworth first discusses the historical background for the science of vocational psychology and in this connection he most severely criticizes the alleged science of physiognomy which has recently been revived. He points out that the true psychological test must be employed in such an analysis. We must first analyse all of the occupations,—obtain "Psycographs" of the different jobs, to use the author's term,—and determine the physical, physiological, intellectual, moral, social and temperamental characteristics necessary for each. We must then evolve tests to determine the presence of these same characteristics in the individual who presents himself for examination.

The author discusses the experiments which have been conducted in an effort to obtain a very careful, complete and detailed picture of the mental processes of men who have achieved marked success in their chosen professions. The case of Henri Poincaré, the eminent mathematician and philosopher, is given in great detail and the results indicate that this is a very fruitful line of investigation. This line of attack is important because "it is on some variation of this method that we must largely rely in our efforts to learn to what degree vocational success depends on the presence of demonstrable personal characteristics, rather than on the accidents of time, place and circumstance." It is hoped that eventually we may have such a series of vocational psychographs for all occupations.

Hollingworth considers next the question of specialized vocational tests and methods. There exist to-day "some twenty types of work for which tests have already been proposed, recommended and more or less tentatively tried out." These the author describes and he also attempts to evaluate their worth. The self analysis of the individual is also discussed. In this connection, Hollingworth points out that the more complete this analysis, the greater its value. The lists of traits proposed by Cattell, Wells, Yerkes and LaRue and other workers in this field are given. The author also discusses the method of the judgments regarding an individual's traits of character as passed by his associates. An entire chapter is given up to the consideration of the correlations and evaluations of self analysis, the estimates of associates and the results of objective tests, in which connection Hollingworth reports the results of a new and carefully planned experiment along these lines. The school curriculum as a vocational test is treated in a separate chapter. In a sense the school curriculum may be conceived as constituting an elaborate mental test, inasmuch as it selects and classifies individuals who possess a certain type of mental alertness or patience. It also supplies the individual with certain subject matter which may be of use in after life and affords opportunity of exercising such specific or general abilities as the curriculum calls into play.

The book contains a gratifyingly large number of summaries of experimental studies in which the results are given in great detail. Also a classified bibliography and an appendix of tests and test-blanks are included, which should be of interest to both the technical reader and to the layman. The book is written in an easy non-technical style which is very readily understood. One is impressed by the conservatism shown by the author throughout the discussion and by the keen analysis and good common-sense displayed. A chapter on the vocational aptitudes of women by Leta Stetter Hollingworth is included in the text. This author fails to find any evidence existing at present which tends to show that women should be excluded from any of the occupations examined.

Clark University. SAMUEL W. FERNBERGER.

SIMON ROBERT HOOVER, *The Science and Art of Salesmanship.* The Macmillan Co., 1916. pp. xviii, 193.

This book is intended to serve as a textbook in commercial courses for beginners and for more or less experienced salesmen. The author holds that "salesmen are not such by birth," but that salesmanship is the "result of study and practice." A sale as a psychological process is analyzed into: involuntary attention, voluntary attention, interest, desire, determination or decision, and action. The last part of the second and the whole third chapter are devoted to the salesman's mental attitude. The author advocates not only that "kind of courtesy which will endure slights, and sometimes even insults, without retaliation" but also a courtesy which "must be the real article, not merely a Friar Tuck species of superficial veneer, which can be assumed in the presence of the prospect and discarded on leaving him." His exact meaning of the important terms employed is illustrated by concrete examples, given in an anecdotal fashion, and selected from the sphere of business-life. In his discussion of other requirements for successful salesmen he gives a similar treatment to such terms as poise, cheerfulness, faith, hope, enthusiasm, persistency, alertness, procrastination, initiative, concentration, temper, self-control, tact, diplomacy, patience, ambition, promptness, and dominance of expression. The customers or "prospects" are divided according to temperament into the vital, the motive, and the mental, and their respective characteristics are enumerated. According to motives they are classified as cautious, stubborn, vain, conceited, argumentative, and cunning. The next three chapters deal with the process of the sale, the demonstration, and the closing of the sale and recommend many generalizations for the guidance of the salesman which are well illustrated. In the shortest chapter, less than five pages long, some of the most important suggestions are made on "finding and correcting mistakes." The remaining chapters deal with the "Relations between Departmental Managers and Salesmen," "Department Store Instructions," and "The Salesman's Reward," again each topic being amply illustrated.

While the general style and treatment of the subject seems to the reviewer well adapted to beginners he doubts whether older salesmen, especially if their reading is not supplemented by classroom discussions, will derive much benefit from it, particularly with regard to the psychological aspects of the topic. The crude and superficial analysis of the "prospect" is not suited to foster the right mental attitude in the young salesman toward his—shall we say: "victim." The enumerative serial of mental requirements for a good salesman is so disconnected and so superficially related to the general vocation that the young reader will either be overwhelmed by it and give up the attempt to attain it,—for it can be attained by "study and practice"—or else on account of its generality he will gain the conviction that he already possesses most if not all these requirements and therefore will consider further attempts to improve himself as a waste of time. In fact, the list fits any other vocation about as well. With the exception of the picture of the salesman's sample case the other four illustrations are of little instructive value. The whole book is a splendid evidence—if such is necessary—for the urgent need of a psychological analysis of the processes of selling. L. R. G.

JEAN WEIDENSALL, *The Mentality of the Criminal Woman.* Warwick and York, Inc., 1916. pp. xx, 332.

The subtitle "A Comparative Study of the Criminal Woman, the Working Girl, and the Efficient Working Woman in a Series of Mental and Physical Tests" indicates the general scope of the work which was conducted by the Department of Psychology in the Laboratory of Social Hygiene at Bedford Hills, New York Reformatory. The results obtained from 88 convicted women, 16-33 years old, at their first admission to the institute, are compared, step by step, with results from 515 girls 14-15 years old and ready to leave school who were tested by Dr. Helen T. Woolley and Mrs. Charlotte R. Fischer in the Bureau of Vocational Guidance connected with the public schools of Cincinnati, and in part also with similar data from 18 maids, 17-30 years old and working at Vassar College. All tests of the criminal women were given by the author, to one subject at a time, in a quiet and pleasant room, during the first two weeks of admission, while the subject was kept isolated from other inmates, and only if she was in a normal condition, "so that if they fall below the standard series (of school-girls), they do so with everything in their favor." Many other examinations and tests were made on these women, but only those are reported here which can be compared with other groups of subjects.

The results include the physical tests of standing and sitting height, weight, strength of grip for each hand with the Smedley dynamometer, steadiness of hand, and rapidity of the tapping movement during 30 and 60 seconds, as an index of fatiguability. The following mental tests are reported: sorting of 48 cards each marked with a circle of a Hering color, cancellation of letter a, memory span for numbers and the per cent of seven, eight, and nine numbers remembered, substitution, completion of sentences, association by opposites, Woodworth and Wells' cancellation of numbers, facility and character of handwriting checked in terms of Ayers' and of Thorndike's scale and correlated with Binet age, rate and character of reading and number of ideas recalled, Woodworth and Wells' standardized easy and hard direction tests, two new verbal direction tests, ability to tell time, and several Healy-Fernald tests, besides mirror-drawing exercises. The second chapter gives a description of general methods, a classification of subjects for comparative purposes, and 27 pages of original scores made by the 88 Bedford women and the 18 college maids. In the third chapter we find a detailed description of each test as administered, the material and apparatus used in it, the instructions given to the subjects, comparative tables and graphs, and a discussion of the individual results. The comparative tables show for each group of subjects the 25th percentile, the median, the 75th percentile, the differences between the two percentiles and the median, and the upper and lower limits of the scores. In the fourth chapter other tests are reported on, in which 200 Bedford women were examined, including the 88, to make sure that the latter are truly representative of the general type of criminal women admitted to the reformatory, and to compare them in part with the 18 college maids and in part with the 200 Binet subjects. The next chapter presents the social, industrial, and physical records of the 88 women and the 18 college maids, and summarizes them in twelve tables. The last chapter, entitled "Summary and Conclusions" offers six more tables of results, bringing the total up to 94 tables, and one more frequency graph, bringing this total up to 95 curves.

All the tests give "evidence that the reformatory inmates constitute two pretty distinct groups with respect to their intelligence; . . . one group of the Bedford 88 has clustered about the better end of the standard curve, and another group toward the poorer end," the reason being difficult to discover. The only uniform factor separating the two groups seems to have been the amount of progress made in school, the poorer group showing much more retardation in school than the better group. The age of the women seems to have made no difference in the results. On the whole, the great difference in mentality between the 88 Bedford women and the 500 Cincinnati school girls seems to be, not an inability to perform tests, but a mental sluggishness in adaptation to new conditions, a carelessness, indifference, and irresponsibility, fostered, perhaps, by long habits of trying to do work without having fully understood what they are asked to do. "Another result of their habit of not thinking about what they are doing or about what they wish to accomplish is to make them more clumsy in their methods of work than such a group as the (college) maids or than they themselves actually need to be."

But this important result seems to the reviewer to be obtained mostly as a bi-product of the careful observation of the subject's behavior during, and attitude toward, the tests: the elaborate tests themselves and the still more elaborate methods of scoring and computing have only hinted at it. The author says "the fact that in many of the foregoing tests these women vary less from the normal in accuracy of performance than in rate of performance is not without its educational significance;" the reviewer wishes to point out its further significance for the need of a future revision of the present methods of mental testing. Other important deductions as to the mentality of these criminal women are likewise not based on the tests themselves, but on certain other observations for which they incidentally furnished a good opportunity. The implicit criticism of mental tests is thus an appreciable, though not intentional addition to the great value of the work of the Bedford Laboratory.

L. R. G.

FRED CARLETON AYER, *The Psychology of Drawing.* Warwick and York, Inc., 1916. pp. ix, 186.

The general setting and scope of the problem, which is outlined in the first chapter, is the study of drawing and its value in laboratory exercises as a part of teaching the sciences in high-schools and colleges. The second part, chapters two to five, presents a condensed survey of the literature of drawing, discussing the chief contributions from the standpoint of methods of research, relation of drawing to intellectual development and analysis of the drawing products and of the drawing process. This is supplemented by an extensive bibliography of 110 titles, in which the chief points of interest and value of the special works on drawing are briefly indicated. In the third part the author's original investigation is described.

In this part the laboratory procedure in general science is subdivided into: 1. analytical observation with (a) representative drawing, (b) description, and (c) analytical or schematic drawing; 2. laboratory records of 1. (a), (b) and (c); and 3. retention and recall. The author's special problem is "to determine the character of the various interrelations of (these) factors." In the first experiment 51 first year high-school students in a general science class were directed to (a) make a representative drawing (or copy) of a turkey feather in 13 minutes; (b) describe and explain the same object (12 min.); (c) study two groups of details of it according to directions and answer one question each about them (10 min. each); (d) dissect a certain part, observe it under the miscroscope, and answer a question about it (15 min.); and (e) make a diagram showing relative arrangement of observed parts (15 min.). The next step in the experiment consisted in calculating the correlation between school drawing and achievement in other school subjects in the case of 141 normal school students. In the third experiment the same 51 high-school students were directed, 24 hours after the first experiment, (a) "to make a simple diagram of a feather, showing and labeling the parts visible to the naked eye" and (b) to answer certain questions about the object. Two groups of 30 and 31 undergraduates were then asked to observe and draw, first one, then another unfamiliar object, and five days later were given an unannounced examination to test their retention of form and color. A group of 48 graduate students, "immediately after spending seven minutes each in describing and drawing a microscope clip" were asked to give careful introspections about their procedure, according to certain directions. Finally, a class of 16 graduates was divided into two equal groups both observing at separate times the same object (a stuffed bird) and answering the same questions about it; but the first group was then directed to note carefully one particular detail, the second group, a different detail, and afterwards both had to "draw the bird in any convenient position."

The results of all these experiments were carefully scored and the correlations determined by the Pearson formula as well as by the Rank-Difference Method. Among the final conclusions, as stated in chapter 7, the psychological analysis of drawing, while most interesting, cannot be summarized here. Another important result is that "representative drawings do *not* afford a measure of the pupil's progress or an adequate record of the work which he has accomplished," they do *not* aid the memory, but interfere with the formation of scientific concepts. Verbal descriptions and analytical drawings are, however, very useful for these purposes, while memory drawings test retention of spatial and form relationships and call attention to previous omissions and errors. L. R. G.

E. L. Thorndike, W. A. McCall, and J. C. Chapman. *Ventilation in Relation to Mental Work.* Teachers College, Columbia University Contributions to Education, No. 78, 1916, pp. 83.

This monograph contains a brief "Introduction" by Thorndike, an experiment by Chapman on the effects of the conditions of the air on mental work, the conditions being changed daily, and several experimental studies by Thorndike and McCall on the effect of certain conditions of the air upon (1) the rate of improvement of mental functions, (2) the accuracy of judgment, and (3) the choice of alternatives to mental work. All these experiments were "carried on under the auspices of the New York State Commission on Ventilation with the aid of a fund given by Mrs. Elizabeth Milbank Anderson." Only the psychological results are presented; "the chief aims were to measure the effect of heat and expired air upon the quantity and quality of the mental products produced per unit of time, and upon the readiness of individuals to work. Certain statements made by them as to their felt fitness for work and general well-being" are also included. The conditions of the air investigated were: as to temperature, variations of 86°, 75°, and 68° F., as to relative humidity, variations between 80 and 50%, as to movements of air, either almost none or stale air recirculated by four fans at high speed, and as to air supply, either none or 45 cu. ft. per minute per person of outside air. Many precautions were taken to control such variables as practice, fatigue, clothing, etc. The mental work included: color naming, cancellation of 2's and 3's, hard opposites, addition, mental multiplication, typewriting, and evaluations of specimens of handwriting and English composition. The subjects, mostly male university students, were tested in squads of four or five, remaining in some cases four, in others 8, hours, in the test-room. Under certain conditions they worked twice in the same half day for 75 minutes at a time, with a 30 minutes' interval; under other conditions they worked for two hours in succession both in the fore- and afternoon, and in a third set they alternated at short intervals between "maximal effort tests in which the subject is required to do his very best, and * * * option tests in which the subject is requested to do as much or as little as he pleases." Some of the options were mental multiplication of a three-place number, reading a current novel, resting quietly, sleep, conversation, and doing nothing.

The results are best stated in Thorndike's words, taken from his final section, "Summary and Interpretation," where he says: "With the forms of work and lengths of period used, we find that when an individual is urged to do his best he does as much, and does it as well, and improves as rapidly, in a hot, humid, stale, and stagnant air condition * * *as in an optimum condition. * * * We find further that when an individual is given work to do that is of no interest or value to him and is deprived even of means of telling how well he does it, and is in other ways tempted to relax standards and do work of poor quality, he still shows no inferiority in the quality of the product produced in stagnant air. * * * Finally, we find that when an individual is left to his (or her) own choice as to whether he shall do *mental work or read stories, rest, talk, or sleep, he does as much* work per hour when the temperature is 75° as when it is 68°."

In his efforts to reconcile these results with the contrary experiences of daily life, Thorndike suggests that "the discomforts to which men have responded by ceasing mental work might perhaps better be responded to by working to pay for an electric fan, taking cool baths, or thinking out ways to reduce the physical exertions which accentuate the discomforts." He might have added the frequent observation that the *busy* person feels the unfavorable air conditions usually *less* than the *idle* one. His final word is "when heat reduces mental work it may do so *via* the general discomforts which it causes rather than by any intrinsic disability or unreadiness in the process of mental production itself." In an Appendix the instructions to the subjects for the tests employed are given in detail.

This monograph is by far the most important and valuable contribution *to "bionomic" psychology that has appeared in recent times,* and it is hoped that its author may find further means to extend it so as to investigate conditions for longer periods of work and to analyze in greater detail the mental states of the subject's comfort or discomfort, for in this point seems to lie the great psychological significance of work under unfavorable conditions of the air.

L. R. G.

BOOK NOTICES

GEO. R. EASTMAN. *Psychology of salesmanship.* Dayton, Ohio, Service Pub. Co. (c. 1916.) 267 p.

GEO. R. EASTMAN. *Psychology for business efficiency.* Dayton, Ohio, Service Pub. Co. (c. 1916.) 265 p.

In the introduction of the first book the problems in general are discussed. Part one takes up the making of the sale, including the training of the salesman, parts of the selling process, the pre-approach, aspects of solicitation, dealing with objections, marking down, etc. Part two takes up the process of thinking, feeling and acting, and here the psychology comes in. We are told many remarkable things concerning behavior, experimental psychology, mind, brain, habit, memory, learning process, instinct and attention, will, thinking, judgment, reason, etc. This is the weakest part of the book, and the topics are treated in the most schematic way. The third part, however, is not much better from a psychological point of view. It deals with factors which determine thinking, feeling and acting, such as instinct, will to live, interests, desire, value, price, truth, etc. We are told that this book is intended for those who believe salesmanship an honorable profession rendering an important and difficult service, and who believe that the salesman is not born ready-made.

In the second book the author first proves that business is connected with psychology, then expounds the process of thinking, feeling and acting. In an introduction he tells us about mental and physical processes, subject and object, mind and matter, knowledge of others, etc., and then discusses conscious purpose, association of mental processes, memory, reason, interest, attention, will, thinking, reflex arc, will to live, man as a social being, complication of interests, suggestion, hypnotism, belief and truth, etc. There is not much indication that this author has thought or even read very deeply in psychology. Perhaps the conning of this book might do good to those who know little or nothing of the subject, but the value of such works as the above seem to the writer of this note rather questionable.

The following books and monographs have been received:

LEWIS M. TERMAN. *The Measurement of Intelligence.* Houghton Mifflin Company, 1916.

J. E. WALLACE WALLIN. *Experimental Oral Euthenics.* Reprinted from *Dental Cosmos,* April and May, 1912.

—— ——. *Psychological Aspects of the Problem of Atmospheric Smoke Pollution.* Pittsburgh, 1913.

—— ——. *Psycho-Motor Norms for Practical Diagnosis. Psychological Review Monograph Series,* Vol. 22, No. 2, August, 1916.

—— ——. *Missouri Children's Code Commission.* December, 1916.

SIGMUND FREUD. *The History of the Psychoanalytic Movement.* Translated by A. A. Brill. Nervous and Mental Disease Monograph Series, No. 25. New York, 1916.

GEORGE D. HALSEY. *Self-Analysis in the Choice of a Vocation* and *Outline of the "Average Opinion" Plan.* Vocational Bureau, Chamber of Commerce, Atlanta, Ga., 1916.

The American Journal of Sociology. January, 1915.

Kentucky High School Quarterly. January, 1917.

NOTES

The Economic Psychology Association held its second annual meeting on January 26 and 27 in the Psychological Laboratory of Columbia University. The chief problems with which nearly all the papers dealt, either directly or indirectly, were the selecting, the training, and the retaining of employees. Most of the speakers were practical business men who have to face these problems in managing the affairs of their business; and it was instructive to learn what is the attitude of these business men toward the contributions which psychology has made to this subject. Psychologists are, as a rule, rather modest as to the practical value of their work; and there seems to be no immediate danger that their results will be mastered and applied by the business world, if one may infer from such progressive business men as constituted the New York gathering. Although business is calling loudly for help from psychology, the business man is either not ready to go half way and find out what psychology already has to offer, or else he demands quicker methods and "quicker returns" than science can promise. There seems to be a similar attitude in the industrial world toward medical contributions, as one of the speakers pointed out. Psychologists will be surprised to learn that department stores are still waiting for an adequate means of testing color vision, suggestibility, etc. There is clearly a lack of coöperation between psychologists and business men; the Economic Psychology Association aims to remedy this defect, and at the same time to serve as a clearing-house for the exchange of such practical devices as their various members have found to be valuable in their work. While a great deal of good might be accomplished by such an organization, it would seem that the present mode of handling the affairs of this particular Association is not well adapted to its purposes. With the exception of a few psychologists who were conspicuous by their silence, most members of the audience had evidently come to be heard rather than to listen. There is a danger that these meetings may be made a subtle means for promoting business schemes, just as laboratories of industrial research are sometimes regarded rather as a subtle means of advertising than as institutions for research. At any rate, secrecy for the sake of selfish advancement will never attract the hearty coöperation of scientists. Not until business firms are willing to come into closer contact with psychology will they be able to profit from the results which have been yielded by psychological investigation.
L. R. G.

From the San Francisco *Bulletin*, Jan. 18, 1917, we quote the following lines concerning the plans and work of Dr. Lillien J. Martin, former professor of psychology at the Leland Stanford, Jr. University: "She was making an interesting experiment. She was going to see if she could not put her knowledge of the workings of the human mind at the service of those whose minds were acting in a way not entirely healthy and normal. * * * She believed that psychology, being at the foundation of all human life, ought to be understood and used. A knowledge of its laws would help people to learn how to live. * * * 'Every day I am impressed by the need in modern life of a confessional conducted along scientific lines.' * * * Many of the cases were so baffling that they required on the part of the expert a great deal of time and patience. * * * Dr. Martin refers to her work as 'personal mental hygiene.' * * * She looks forward to the time when it will be put on a level in the schools with physical hygiene and when the laws now known in regard to memory attention, suggestion, habit, and fatigue will be made clear to the young for their intellectual and emotional guidance."

Dr. William Healy, one of the Cooperating Editors of the JOURNAL and at present Director of the Juvenile Psychopathic Institute in Chicago, is to assume the Directorship of the Judge Baker Foundation of the Juvenile Court in Boston, Mass.

The cause of applied psychology has recently suffered a great loss in the sudden death of Professor Hugo Münsterberg of Harvard University. While lecturing to a class of Radcliff students, on December 16, 1916, he was stricken and after a few minutes succumbed without regaining consciousness. For several years he had been conducting experimental investigations in various fields of applied psychology, and his public addresses and numerous articles in popular magazines as well as his books have greatly helped to spread far and wide the present interest in psychology and its practical applications. One of his last efforts was in behalf of The Journal of Applied Psychology, as he had gladly consented to become one of its cooperating editors. His originality in thought, his keen sense for systematic organization of new psychological results, his deep philosophical appreciation of all scientific advances, and his ability to express in fascinating language the newly discovered truths of mental life have earned him a position of highest rank in the psychological world.

THE EDITORS.

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THE PSYCHOLOGY OF A PRODIGIOUS CHILD

By CHARLOTTE G. GARRISON, AGNES BURKE and LETA S. HOLLINGWORTH,
Teachers College, Columbia University

The pendulum of social and educational interest has swung in recent years so far toward the study and treatment of the mentally defective that the term "exceptional child" has been corrupted from its proper meaning, and has come to be popularly used as a euphemistic designation for the mentally deficient and neurotic. "Exceptional" properly means deviating either above or below the average, but ever since science has furnished us with the means of determining exceptionality in children, it is the undesirable and unprofitable deviate only who has claimed the attention of society.

It is extraordinary that educators have not turned long ago to the business of identifying and studying those children who deviate from the average in the direction of superiority. It is true that Terman,[1] as early as 1905, was interested in precocity, and he has published further work on the subject from time to time. In his recent book[2] he has especially stressed the desirability of studying superior children. Stern[3] also expressed an interest in such work, and a few fragmentary accounts have appeared from other authors. It is reported that Whipple has recently obtained a special fund for the experimental study of the education of gifted children, and Elisabeth Irwin, of the Public Education Association, has this year been instrumental in organizing a class of such children in one of the public schools of New York City. But the fact is that superior children have received so little attention as compared with defective children, that parents now feel it as an insult when it is suggested that their child should be "tested!"

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[1] Terman, L. M. Precocity and Prematuration. *Am. Jour. Psych.*, 1905.

[2] Terman, L. M. The Measurement of Intelligence. Houghton, Mifflin Co., New York, 1916.

[3] Stern, W. The Supernormal Child. *Jour. of Ed. Psych.*, 1911.

From time to time we hear through the newspapers of children who are alleged to possess extraordinary intellectual powers and abilities. "Infant prodigies" we call them. Such children as William James Sidis and Winifred Stoner are current examples. It is claimed for both of these children that their prodigious achievements are the result of special systems of education. So far as is known the intelligence of such children has not been quantitatively measured.

Biography gives us stories of juvenile prodigies like J. Stuart Mill and Thomas Macauley, who are said to have enjoyed the classics in their infancy, and who both lived to prove their genius by adult achievement. It is obvious that it would be of very great educational value if we now had mental measurements of those children who grew up to be men and women of genius. For example, if we had a scientific record of the mental status and development of J. Stuart Mill, of Thomas Edison, of Madame Curie, of Abraham Lincoln and of George Eliot up to the age of fifteen years, or if we knew the intelligence quotients of all the Nobel prize winners at the age of eight years, what guidance for educational practice might be contained therein!

As it is, we know practically nothing of those children who have become the intellectual masters of mankind. Were they superior children or ordinary children? Or, as is often alleged, were they backward children? At what age could their future possibilities have been predicted by the use of intelligence tests? What were their temperamental and moral characteristics? Were their abilities special or general? Were their interests symptomatic of the abilities that they were to display? To none of these questions can we give any answer at all. If educators should now begin to collect quantitative measurements of the intellects of all children who deviate from the norm in the direction of decided superiority, we should know in fifty or one hundred years from now whether and to what extent superiority in childhood is correlated with superiority of achievement in adult life. Science has already furnished us with a means of identifying exceptional children, and of measuring the amount of their exceptionality, so far as intelligence is concerned. If science within the next fifty years should furnish us with the means of prophesying adult achievement on the basis of the child's exceptionality, the history of human progress might be modified in ways of which we now can but vaguely guess. We should then be able to select and cherish human genius without regard to race, sex or condition of economic servitude. We should preserve the impecunious boy from the dyspepsia or tuberculosis which waits upon bad food; we should not then, as now, guide the little girl with an intelligence quotient seventy-five per cent above the average to the dish pan and the carpet sweeper.

It is the purpose of this paper to record the psychological and physical measurements of a prodigious child and to give his personal history. This child is of that degree of exceptional intelligence possessed by but one child in more than a million. Thus it seems worth while to make the records detailed. There is no fear that such reports will multiply beyond reasonable limits, for only a few children of such ability are born in a single generation.

E——— is a boy eight years and four months of age. He was born June 17, 1908, and the psychological measurements were made on November 4, 1916. The circumstances that led to acquaintance with him were as follows. A child of exceptional intelligence was desired for demonstration before a class in the psychology and treatment of exceptional children in Teachers College, and this child was suggested on account of his remarkable school record. The consent of his parents was secured and the psychological examination was made before a class of about thirty students. These are of course not the ideal circumstances under which to perform a mental test for scientific record. The presumption would be that the audience would tend to reduce the child's performance, so that whatever error there may be from this source would be in the direction of making the child appear less exceptional than he really is. Of course no one knew beforehand that such a phenomenal record was about to be made; for had such an unusual result been expected this child would have been kept for examination under more favorable laboratory conditions.

General Intelligence. The Stanford revision of the Binet-Simon measuring scale was used for the determination of the child's mental level, and the examination was made by Dr. Hollingworth. The examiner began with the "ball-in-the-field" test. E—— responded at once with the superior solution, thus giving a preliminary cue to the quality of his mind, and the examiner proceeded immediately with the other tests at the twelve-year level of intellect. E—— passed all of the twelve-year tests with facility and ease, giving responses of excellent quality. From the twelve-year level the examiner then worked forward in all the higher levels through "superior adult." This is, of course, a long examination, and in view of the actual age of the child it was deemed best to give the tests at two separate sittings, when it was seen that he would cover the whole upper range of the scale. The examination was therefore accomplished in two sittings of about fifty minutes each. The final record of E—— shows that he measures on the scale as follows:

	Yrs.	Mos.
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
12	12	
14		16
Adult		15
Superior adult		12
Total	15	7

Since his actual age is eight years and four months and his mental age is fifteen years and seven months his I.Q. (Intelligence Quotient) is 187. On the curve of the distribution of intellect he stands eleven times the probable error removed from the norm, a position occupied by but one child in more than a million. He stands as far removed from the average, in the direction of superiority, as an idiot stands removed in the direction of inferiority.

An analysis of his performance shows that E—— has extraordinary appreciation of the exact use of words, and of the shades of difference between words. His vocabulary is about that of an average adult. He gave correct meanings for 64 words out of the 100 in the vocabulary test. His vocabulary thus includes 11,520 words. The score of the average adult is 65 words. Thus he just missed scoring on this average adult test. Samples of his definitions are as follows:

scorch—is what happens to a thing when exposed to great heat.
quake—is a kind of movement, not intended.
ramble—is a walk taken for pleasure.
nerve—is a thing you feel by,—for instance, cold.
majesty—a word used to address a king,—your majesty.
Mars—is a planet.
peculiarity—is something you do that nobody else does.
mosaic—is a picture made of many small pieces of marble.
bewail—is to be extremely sorrowful.
tolerate—is to allow others to do what you don't like yourself.
lotus—is a kind of flower.
harpy—is a kind of half-bird, half-woman, referred to in Virgil.
fen—is a kind of marsh.
laity—is *not* clergy.
ambergris—it comes from a whale.
straw—the stalk of a cereal plant.
lecture—someone giving a very long talk about something to an audience.

E—— also has a prodigious ability for comprehending and formulating abstract ideas, and for working with symbols. He gave the differences between the abstract concepts under "average adult," test 3, as follows:

a. Laziness and idleness. Laziness is that you don't *want* to work; idleness is you *can't*, for a while.
b. Evolution and revolution: Evolution is making things from the beginning; revolution is changing them.
c. Poverty and misery: Poverty is when you don't have anything; misery is how you feel when someone insults you.
d. Character and reputation: Character is what he *really* is; reputation is what they *think* he is.

He succeeded in reversing the clock hands three times without any error, in less than a minute for each trial. He was able to reproduce the thought from the selection beginning "Many opinions have been given about the value of life," as well as a superior adult. He solved the three mental arithmetic problems under XIV, 5 in less than a minute each, absolutely without error. These performances serve to illustrate his precocious power over symbols and over abstractions. His attention, concentration and capacity for sustained effort are illustrated by the fact that he was able to repeat five digits backwards twice out of three trials absolutely without error, before a class of thirty adults. His memory span for digits repeated forwards is at least 8. (He was not tried with more than 8 digits.)

During the examination he showed neither embarrassment nor any tendency to "show off." He was alert, interested, and gave his attention strictly to the business in hand. He always knew when he had failed on a test, and gave up with great reluctance. For example, he was unable to solve the problems under XVIII, 6, in the time allotted; but he carried these data away in his head, and held to them tenaciously till he had solved the problems. In several instances after he had given his reply he recast it in better form. In short, he exemplified in remarkable degree all of the characteristics which Binet finally chose as symptomatic of intellectual power, i. e. (1) the ability to take and maintain a given direction; (2) the capacity to make adaptations for the purpose of obtaining a desired end; and (3) the power of auto-criticism.

Special Tests. Following the procedure described by Seashore, and using the set of forks recommended by him, E—— was tested for pitch discrimination, being given seven trials with the whole series of forks. His record was as follows, # meaning a correct answer and — meaning a false one.

	Vibration differences									
Series..........	30	23	17	12	8	5	3	2	1	.5
1..............	#	#	#	#	#	#	#	#	#	#
2..............	#	#	—	#	#	#	#	#	—	
3..............	#	#	#	#	#	—	#	—	—	#
4..............	#	#	#	#	#	—	#	—	#	—
5..............	#	#	#	#	#	#	#	#	—	—
6..............	#	#	#	#	#	—	#	#	#	#
7..............	#	#	#	#	#	—	#	—	#	#

His threshold for pitch discrimination would thus seem to be not greater than five vibrations, and would probably be found to be as low as three if a more complete test were possible. This is a very good record, according to Seashore's standards.

E—— gave free associations to the first 50 words of the Kent-Rosanoff list of words, both stimulus words and responses being oral. The stimulus words and responses follow.

Stimulus	*Response*	*Stimulus*	*Response*	*Stimulus*	*Response*
table	dinner	smooth	surface	needle	slim
dark	night	command	army	red	color
music	soft	chair	cushion	sleep	fast
sickness	fatal	sweet	sugar	anger	sick
man	tall	whistle	blew	carpet	bagger
deep	ocean	woman	lady	girl	pretty
soft	couch	cold	coal	high	mountain
eating	dinner	slow	train	working	people
mountain	snowcapped	wish	I	sour	lemon
house	brick	river	Hudson	earth	big
black	dog	white	color	trouble	great
mutton	beef	beautiful	dress	soldier	brave
comfort	your	window	glass	cabbage	green
hand	dirty	rough	surface	hard	surface
short	man	citizen	U. S.	eagle	swift
fruit	orange	foot	bare	stomach	ache
butterfly	moth	spider	black		

At once after giving some of these responses he explained why he had given them. Thus he explained that "carpet-bagger" had to do "with Civil War history." After giving "beef" in response to "mutton" he smiled and said, "That's a joke, isn't it?" When asked why he thought it a joke he replied that he thought very few people would give that answer. After the test he was told that 97 people in a thousand gave "beef" in response to "mutton" and he at once said, "Ten per cent, that's not so *very* many."

It was impossible for lack of time to give the complete list of 100 words, usually given in this test. Using the 50 as a basis of calculation, 78% of the responses are "common responses" in the Kent-Rosanoff sense of the word, a number of common responses which children do not usually show until after the age of 10 years. His "median of community" (a measure not yet standardized for age levels) is 1.4%.

He was given the Pintner form of the Knox Cube test, and achieved 11 of the 12 lines arranged by Pintner. The average record for the 16 year old is only 8 lines, and this is the highest level for which the test is yet standardized.

The usual Tapping Test was given, tapping continuously with the right hand, with the stylus, for one minute. The record was 239 taps only, which is lower than the average 8 year old record.

Given three minutes in which to make up words out of the letters a-e-i-r-l-p, he made the following,—a, rip, pie, lie, ale.

He was given thirty minutes in which to put together the pieces in the Stenquist Construction Box II, and was not able to put any of the pieces together. He began at one end of the box, examined each set of materials in turn, tried to put them together in an indiscriminate way, put them back and went on to the next set of materials. He remarked, "I don't seem able to put any of them together. It seems that all I can do is to find out what each of the things is for." He recognized that various sets of pieces were "a mouse trap," "a lock," "a bell," etc., but made a zero score from the point of view of construction. At the end of twenty minutes he gave up and turned away from the materials.

It is interesting to compare the child's record in construction tests, and his comments regarding these tests, with his school record in *industrial arts* and *fine arts*. E—— receives the best possible rating in industrial arts because he has keen insight into *processes*, and can explain how to construct a mechanism or perform an operation clearly and minutely, though he is unable to carry out his own instructions. For instance, he can tell exactly *how to make* a boat, but cannot *make* the boat himself. There is thus an interesting distinction here between "constructive ability" and "manual dexterity." Similarly, in fine arts E——has many ideas for decorative schemes, but he is unable to execute these ideas *with his hands*.

Developmental History.[4] E—— was the fourth child, three girls having been born before him, all having died. Birth was difficult. He was bottle fed. His parents were both in middle life at the time of his birth. He cut his first tooth at eight months,—a lateral incisor. He walked at thirteen months. Up to two years of age E—— did not say a word. He then began to talk, and before he was three years old was able to read such books as "Peter Rabbit." Conversation with him was carried on in German, French, Italian and English equally. When he did begin to talk he could say all the words he knew in these four languages. His health has been exceptionally good from infancy. He has had no disorders or diseases except measles, and an occasional attack of indigestion. He is exceptionally free from colds.

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[4] The developmental history and history of personal health were elicited from the mother, who, being a physician, is especially competent to speak on these points. The family history, and the facts respecting his extra-school linguistic achievements were also given by the mother.

Physical Measurements	E— Oct 30, 1916	Age, 8 yrs. 4 mos., average
Weight	89.3 lbs.	70.5 lbs.
Height	54.3 in.	54.3 in.*
Girth of chest	31.8 in.	25.6 in.
Girth of chest, expanded	32.4 in.	26.8 in.
Lung capacity	100.0 cu. in.	112.0 cu. in.
Strength, right forearm	30.9 lbs.	39.7 lbs.
Strength, left forearm	22.0 lbs.	37.5 lbs.

* These averages are for a boy of this age *and height*. The average *height* for a boy of 8 yrs. 4 mos. is 49.7 inches. The measurements are transcribed from the gymnasium records of the school where E— attends.

It will thus be seen that E—— is considerably larger than the average boy of his age. He has clear, well-molded features. The child does not like physical exercise of any kind, but has had special attention along this line, such as lessons in swimming, dancing and horseback riding. He sleeps eleven hours, and goes to sleep immediately upon going to bed.

School Achievement. E—— went to kindergarten from the age of three years to the age of five years. From five to six he was out of school on account of school organization (he could not be accepted in the first grade). From six to seven years of age he attended an open air, ungraded school, and did the work of the second to the fourth grades. From seven to eight years he was in the fourth grade in regular school classes, and at present, at the age of eight years, he is in the sixth grade. He is thus three full years accelerated in school grading, according to the age-grade norms, but is still three years retarded in school grading according to his mental age. (Terman makes special note of the fact that superior children are almost invariably retarded in school grading according to mental age.) His mother states that under private tutors E—— has covered the work of the seventh grade and nearly all the work of the eighth grade. His school standing on his last report was as follows. The highest attainable rating is 1; the lowest, 4.

Courtesy	1	Composition	2	Penmanship	3
Promptness	1	Grammar or Language	2	Industrial Arts	1*
System	1	Mathematics	3*	Fine Arts	4*
Spelling	2	Geography	1	Music	2
Reading or Literature	1	History	1	Physical Ed	4
				Science	1

* In industrial arts credit is given for *knowing* industrial processes. as well as for ability to carry out the processes, whereas in fine arts credit is given for manual dexterity only. Private tutors grade E— as 1 in mathematics.

In addition to his regular school work the child has covered the following special work in language and mathematics, either with a tutor or with his mother: *Geometry; algebra,* as far as equations; *Latin,* partial knowledge of the four declensions, (he has been taught by the direct, informal method, and reads easy Latin); *Greek,*—worked out the alphabet for himself from an astronomical chart, between the ages of five and six years; *French,* equal to about two years in the ordinary school; *German,* ordinary conversation; *Spanish,* attended class with his mother,—reads and understands; *Italian,* reading knowledge, simple conversation; *Portugese,* asked his mother to take this language at the Columbia summer school because he could not be registered himself; *Hebrew,* a beginning; *Anglo-Saxon,* a beginning. In *Astronomy* he has worked out all the constellations from MacCready, and displays a very great interest in this subject. One evening this winter he noticed a new planet near the Twins. He said it was Saturn, but his mother thought it was Mars. E—— went home, worked the position out from the chart, and found it to be Saturn. He has a great interest in nature wherever found, and is already able to use Apgar intelligently. His writing is not equal to his other accomplishments. He is very slow at it and for this reason dictates most of his "home work" to a stenographer. History is his chief and absorbing interest among school subjects.

Social Habits, Tastes, etc. E—— does not care to play, and would never do so unless forced. He is very impersonal and agreeable in his attitude toward other children. His chief diversion is reading and his favorite book at present is *Ivanhoe.* He has no hobbies. In the spring of 1916, after careful and thoughtful preparation, he joined the Episcopal church. His desire is to be a minister and become a missionary. When asked what he would consider the most fun in life he replied, "To have statistics of my imaginary country." This country is on Venus. It is inhabited by people and has a navy like ours. E—— does not volunteer much information about his interests. All of these items had to be elicited by questioning.

Family History. Father: College graduate. Produced a Latin play, which was given in a Boston theatre, while still an undergraduate. Since graduation has maintained a keen interest in educational matters. Organized a special library of insurance in Boston, which is now used as a reference library all over the world. Is at present engaged in business. Has written many books. Is a university lecturer on insurance. Has served on many important city commissions.

Mother: Holds the following degrees: A.B., Boston University; A.M., New York University; M.D., Medical College (now merged with Cornell); LL.B., New York University Law School. Post-graduate study, Johns Hopkins one year and Germany six years. Special study in bacteriology and pathology in Germany and Paris. Has done research for Rockefeller Institute in bacteriology of milk, and has published notable research in this field. Publication awarded a medal at the St. Louis Exposition. Sent as a delegate to medical congresses in Rome and Moscow.

In the present state of our knowledge, no prognosis as to the future achievements of such an exceptional child can be advanced on a scientific basis. The data here collected are of significance in that they show how far it is possible for a child to vary from the norm in the direction of superior intelligence. They also suggest the value of studying the psychology of precocious children, so that we may advance our science to a point where we shall be able to prognosticate concerning them.

THE BINET VERSUS THE POINT SCALE METHOD OF MEASURING INTELLIGENCE[1]

By Robert M. Yerkes

Ladies and Gentlemen: I have several important reasons for wishing to discuss this particular methodological aspect of psychology at this time and in this institution. Human engineering on the basis of mental measurement is progressing so rapidly that we have cause to doubt the adequacy of our methods. We face the fact of the almost universal application of such methods of measuring intelligence as the Binet and Point Scales, yet these measuring instruments are extremely crude and at the same time obviously improvable. It is equally our duty and our opportunity to so modify or replace them that our results shall steadily increase in accuracy and reliability. As it happens the three men who have done most to adapt the Binet scale to American needs and to improve it—Kuhlmann, Goddard, and Terman—as students in this institution have enjoyed the privilege of working under the guidance of the foremost of genetic psychologists.

The profound significance of natural science for civilization is no longer seriously questioned. The world war has convinced us, on the one hand, that the physical sciences are far in advance of the biological and social sciences, and on the other hand, that there is imperative need of systematic attention to the latter group of sciences. Many of us are wholly convinced that the future of mankind depends in no small measure upon the development of the various biological and social sciences. Among these physiology, psychology, and sociology are preëminently important. We must, I submit, if we are adequately to meet after-war demands and improve the opportunities which will then be offered us, strive unceasingly for the improvement of our methods of mental measurement, for there is no longer ground for doubt concerning the practical as well as the theoretical importance of studies of human behavior. We must learn to measure skilfully every form and aspect of behavior which has psychological and sociological significance. Such are a few of my reasons for wishing to compare critically the two most prominent methods of measuring intelligence.

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[1] Read by invitation of President G. Stanley Hall before his Psychological Seminary, March 19, 1917.

Being Psychopathic Hospital Contributions Whole Number 171 (1917.5). The previous contribution was by Rose S. Hardwick (1917.4), entitled "The Weighting of Point Scale Tests." To be published in *Journal of Educational Psychology.*

These methods are too well known to demand historical introduction. Although each is at present widely used, they differ radically in principle and might reasonably be expected to yield strikingly different results. Measurements of intellectual forms and aspects of behavior are of two principal sorts: (1) the scale or group-test procedure, and (2) the single or specific functional measurement. Both the Binet and the Point Scale are groups of tests. It is essential for us, at the beginning of this discussion, to note that for scientific purposes the ideal method of measuring behavior is the specific functional test. Scales are technological tools which have been devised to satisfy certain practical demands. The inevitable direction of development in our mental measuring is toward the graded, standardized, highly accurate, specific test or method. Groups of tests or, as it is convenient to call them, scales, are likely to persist and multiply because they will continue in increasing measure to meet important human needs.

But even now we may appropriately ask, should both the Binet and the Point Scale methods be further developed and improved, should the one or the other be wholly abandoned, should both be given up and in their place a new type of scale embodying perhaps the best principles of each be created, or, as yet another possibility, should the grouping of tests be abandoned and recourse be had to highly developed single functional tests?

At the risk of seeming to reverse logical procedure, I wish at once to suggest my tentative answer to these questions, for after all, this discussion may be endured only for the sake of the conclusions. I believe, in the first place, that scales or groups of tests can not well be dispensed with. I further believe that we should concentrate our efforts on the development of reliable methods of measuring the various types and aspects of practically significant human behavior. In order to fulfill the conditions which these two conclusions impose upon us, I wish to suggest the desirability and the feasibility of developing a scale for the measurement of intelligence which shall at once combine the safe and serviceable principles of the Binet and Point Systems and improve upon them. This new scale should take account alike of the qualitative and quantitative aspects of behavior. It should consist of carefully selected and graded tests. It should be standardized in such wise that its constituent parts might be used independently, thus serving the purpose of specific functional tests. It should be possible to embody in a single scale all the advantages of existing methods of measuring intelligence, and even to add to them.

There are those who insist that the Binet and Point Scales are not essentially different. It has even been said, carelessly, that the latter is merely a revision of the former method. Such statements are surprising indeed in view of the facts to which I must now call your attention.

Careful analysis of the two scales indicate that they differ more or less radically on three fundamentally important points: (1) the method of selecting or choosing their constituent parts (tests of intelligence); (2) the method of standardizing their tests or combinations of tests; and (3) the method of measuring and expressing the subject's response.

METHOD OF SELECTING TESTS

The various tests or methods which make up the Binet scale are selected in accordance with the number of successes or failures at various ages. If a particular test is passed by a certain percentage of individuals at eight years of age, by a lower percentage at seven years, and a higher percentage at nine years, it is, other things being equal, deemed suitable for the eight-year group. It thus appears that tests are chosen in the light of success or failure and arranged in age groups. This method apparently rests upon the assumption that important forms of behavior appear at various times during infancy, childhood, and adolescence. By contrast, the methods which constitute the Point Scale are chosen from the standpoint of functions to be measured, and without regard to their particular relations to the stages of human development. It is assumed in the construction of the Point Scale that all of the important types of intellectual function are present in early childhood and develop more or less rapidly. If this be true, tests or measures for all fundamental forms of intellectual behavior should be available no matter what the age of the subject. Briefly put, the Binet is an age-scale based upon the assumption of *appearing functions;* the Point Scale is a functional scale, based upon the assumption of *developing functions.*

Genetic psychology justifies the statement that all important types or classes of intelligent behavior are represented in the human action system by the end of the third year of postnatal life. Thereafter new acts belonging to the same types continue to appear for some years and all tend to become complexly related to one another and to innate reactive tendencies.

As one result of the heterogeneity of tests within the Binet scale groups, the measurements made on individuals of different ages are not strictly comparable, for the obvious reason that different forms or aspects of behavior have been measured in the two cases. In support of this statement, I need only contrast the tests which make up the five-year and eight-year Stanford-Binet groups. In the five-year, there appear (1) comparison of weights; (2) naming of colors; (3) aesthetic comparison; (4) definition by use, or better; (5) patience, or divided rectangle; (6) three commissions. The eight-year group consists of (1) the ball and field test; (2) counting backward, 20-0; (3) comprehension of questions; (4) giving similarities of two things; (5) definition superior to use; (6) vocabulary. Even the most enthusiastic believer in the Binet scale and method cannot hope to maintain the thesis that at each or even at any two ages precisely the same forms or aspects of human behavior are measured. In the Point Scale, it is the ideal, thus far only partially realized, to measure the same and the most fundamental features of behavior at every age, and thus to obtain strictly comparable results from year to year.

METHOD OF STANDARDIZATION

The Binet Scale is internally standardized; the Point Scale, externally. For the former method, the process of selecting tests according to percentage of passes and of grouping them according to age constitutes standardization. The result of this method of selecting and standardizing tests is an inflexible scale, which, however, accurate it may be for the race, social stratum, or sex, for which it was constructed, cannot possibly yield reliable results when applied to widely differing groups of individuals. For this reason an internally standardized method of measuring behavior is defective.

The Point Scale may be described as externally standardized because the selection and arrangement of the tests have nothing to do with the norms which as standards of judgment are used in the evaluation of results. With the application of the Point Scale to increasing numbers of individuals, the norms, whether for age, sex, race, educational or social status, become increasingly numerous and reliable, and the value of the method correspondingly increases. In order to use the Point Scale profitably for a new race, or social group, it is necessary only to make a sufficient number of examinations to yield reliable norms. They immediately become standards of judgment. The method does not have to be revised. Thus it is evident that where the Binet Scale is inflexible, the Point Scale is flexible and universally applicable.

METHOD OF MEASURING AND EXPRESSING RESPONSE

The third fundamental difference mentioned above appears in the method of measuring and expressing reaction. The Binet Scale supplies judgments of success or failure. These have been described as all-or-none judgments. From the scientific point of view, they are but rough approximations to the desired and desirable measurement, since they are rather the forerunners of quantitative statements than themselves quantitative. In the Point Scale, judgments are of the more-or-less sort. In other words, there is not a judgment of "pass" or "fail," but instead, there is awarded a particular amount of credit, which supposedly varies in correspondence with the character or amount of response. The Binet measurement is neither qualitative nor quantitative, but marks the transition. The point-scale measurement is distinctly quantitative. But in so far as the ideal of point-scale construction is achieved, the method takes account of qualitative as well as quantitative differences in response. The importance of this contrast in the methods which we are considering has, I think, been fully appreciated by very few critics. It is, in fact, the difference between a relatively unscientific procedure and one which is striving to fulfill the essential requirements of scientific method.

There is, moreover, a profoundly important corollary. The type of measurement which the Binet Scale yields is amenable to statistical treatment only in a very restricted way. Thus the mean or standard deviation, the probable error of mean or deviation, the co-efficient of correlation with its probable error either cannot be obtained at all for Binet judgments or are of slight value because of the non-quantitative character of the judgments. By contrast, point-scale measurements can be statistically treated in all the varied and biologically significant ways. In my opinion, it is primarily because of this merit, that the Point Scale has gained so rapidly its wide recognition and use. The advantage which it has, from the statistical standpoint, over the Binet method is tremendous, and only those persons who are unfamiliar with the essentials of scientific method or incapable of appreciating the value of statistical data fail to note and respond to this difference. The Point Scale because of this characteristic is at once a technological tool and an instrument of research. The Binet Scale is technologically useful, but possesses little research value.

WEIGHTING OF TESTS

It has been objected by some critics, that the point-scale system is unsatisfactory because the various tests are weighted in the light of no definite scientific principle. This adverse criticism I accept as valid, but in fairness it must be pointed out that it applies with equal force to every other scale whose several measurements are averaged or in any other way combined. Thus, for example, the Binet Scale gives equal weight to all the tests of a given age group, despite the fact that they may be concerned with utterly different modes or aspects of response whose practical importance in the individual's life must vary extremely at any given time as well as with age and the correlation of which with general intelligence is known to vary greatly. I submit, not in defense of the point-scale procedure but merely in fairness to it, that the Binet Scale is quite as much in need of a sound and systematically applied principle of weighting as is the Point Scale.

But ground for defense is not utterly lacking. The point-scale tests were not weighted in haphazard fashion. Instead, varied experience in actual examining, coefficients of correlation with general intelligence and of one type of measurement with another were considered and the weightings apportioned as carefully as was possible in the absence of any single and obviously satisfactory principle. The principle which we propose to apply in the further development and perfecting of the point-scale system is that of weighting in correspondence with the correlation of a particular measurement with general intelligence, or rather with the point-scale score.[3] The higher the coefficient of correlation, the greater the credit for a particular test. This principle we are trying out. If it stands our tests, we shall have met our critics squarely, and at the same time shall have gone beyond the Binet Scale in regard to scientific qualifications.

CHRONOLOGICAL VERSUS PHYSIOLOGICAL AGE

Yet another important consideration remains to be mentioned before an attempt is made to sum up the contrasting characteristics of the two methods. The use of chronological age in connection with mental age as a basis for the statement of individual status is scientifically without justification. The rapidity of growth and of the maturing of organic structures and functions varies greatly for races, for individuals, for the sexes, for diverse conditions of nutrition and of health. It is consequently unsafe to compare the status or the achievement of two individuals on the basis of their years, months, or days of postnatal existence. That psychologists will ultimately be forced to admit this fact and to abandon or modify their use of chronological age and of mental age in connection with measurements of intelligence is my conviction. Physiological age should be determined and with it the varied results of measurement should be compared or correlated. This means that in case of each examination there should be stated not only the chronological age of the individual but also the physiological age as indicated by carefully chosen measurements of status of the organism and of functional capacity, and finally, the specific results of varied mental measurements in comparison with the expected results or norms for the appropriate physiological age.

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[3] Hardwick, R. S. The weighting of point scale tests. (To appear in *Journal of Educational Psychology.*)

By way of summary, the significant points of contrast between the Binet and the Point systems are exhibited in parallel columns.

	Binet Characteristics	*Point Scale Characteristics*
(1)	Multiple-group, age or year scale	Single graded-test scale
(2)	Selection by relation of successes to age	Selection by function measured
(3)	Varied, unrelated, ungraded tests	Each test so graded as to be available for wide range of ages
(4)	Internally standardized and inflexible	Externally standardized and flexible
(5)	All-or-none judgments	More-or-less judgments
(6)	Qualitative	Quantitative
(7)	Measurements only slightly amenable to statistical treatment	Measurements wholly amenable to statistical treatment
(8)	Tests weighted equally	Tests weighted unequally
(9)	Implicit assumption, that of appearing functions	Implicit assumption, that of developing functions
(10)	Measurements for different ages relatively incomparable	Measurements for different ages relatively comparable

The foregoing discussion has been based wholly upon the latest and most improved form of the Binet method,—the Stanford revision, and upon what the writer knows to be the ideals in point-scale construction rather than the actual achievements as visible to those who know only the original or preadolescent Point Scale described in "A Point Scale for Measuring Mental Ability." All earlier forms of the Binet method are neglected because their imperfections are more numerous and more serious than those of the Stanford Scale. It may therefore be assumed that such criticisms as are applicable to the latter apply with at least equal force to the former. On the other hand, it must be emphasized that the claims which I make for the point-scale system are not wholly justified by the present status of the method. I have ventured to draw the contrast sharply because of my belief that they will be justified by the results of work on the method which is now well advanced at the Psychopathic Hospital, Boston.

In one respect the Stanford revision appears to be especially weak. It includes a number of tests (vocabulary, fables, arithmetical reasoning, and definitions, for example), which are highly dependent upon education. Were it not for this fact, which shortly becomes apparent to any experienced psychological examiner who attempts to use the method, Terman's extension of the scale by the addition of tests for adolescents and adults would be a very great advantage.

ANALYSIS OF THE STANFORD-BINET SCALE

In connection with this comparison of the two systems of measurement, I have attempted to analyze the Stanford revision of the Binet Scale from the points of view of functions measured and the distribution of measurements among the various age groups. In all, ninety tests appear in the Stanford scale. Of these, seventy-four make up the twelve age groups, while sixteen stand as alternates. There are fifty-five different tests, that is, tests so obviously different in constitution and mode of response demanded that they may not be grouped as equivalents. These may further be reduced to the following twenty-five functional groups on the basis of similarity of responses measured.

STANFORD-BINET TESTS GROUPED ACCORDING TO SIMILARITY OF RESPONSES MEASURED

1. Recognizing and naming objects: naming objects, stating sex, stating name, naming colors, stating age, naming coins, naming days of week, naming months of year, morning or afternoon, indicating right and left.
2. Response to pictures.
3. Memory for: syllables, sentences, digits forward and backward, designs, ideas.
4. Discrimination and comparison of lines, weights, forms.
5. Counting objects and fingers.
6. Counting backwards.
7. Copying geometrical forms.
8. Comprehension of questions.
9. Aesthetic judgment.
10. Defining terms.
11. Patience and form board.
12. Executing commands.
13. Discovery of missing parts.
14. Tying bow-knot.

15. Giving differences or similarities.
16. Ball and field.
17. Vocabulary.
18. Dictation.
19. Mathematical reasoning: making change, value of stamps, box problem, ingenuity test.
20. Sentence construction: three words in sentence, dissected sentences.
21. Visual imagination: clock test, Binet paper cutting, rhymes, absurdities.
22. Fables.
23. Induction test.
24. Code.
25. Free association.

Now it might be supposed, prior to examination, that some sort of test for a particular variety of response would appear in each age group, but this is not the case. Instead, the constructors of the scale seem to have systematically avoided not only repetition of a particular test, but even in the main, its repetition in increasingly difficult form. Thus, for example, the well-known Binet test of response to pictures by enumeration, description, or interpretation, appears in the age groups three, seven, and twelve. It does not appear in any of the others nor is there any test which is strictly comparable with it in any one of the remaining nine groups of tests. The definition test which, if it has any practical value, might be supposed to be equally serviceable for all ages, is used for the ages five, eight, twelve and sixteen, and for those alone. Why for these particular ages instead of for any other or others between three years and intellectual maturity is difficult to imagine. Or again, the Stanford test, new to the Binet system, of repeating digits backward appears as an alternate for age seven and as a regular test for ages nine, twelve, sixteen and eighteen. Why, the critical psychologist may well ask, is it not equally serviceable for the ages ten and fourteen? And why, if one chooses to carry this sort of question to its logical conclusion, should not the test be used for all ages from the early stages of linguistic development to intellectual maturity?

As we follow through the list of fifty odd tests which make up this measuring scale, we observe that the number of groups in which a particular test appears tends to diminish. The infantile or childhood tests are many of them repeated in two, three, or even as many as five or six age-groups. But the tests of more complicated or more mature types of response tend, as the accompanying table shows, to be used in only a single group. The only striking exception to this rule is the vocabulary test, which finds place under the ages eight, ten, twelve, fourteen, sixteen, and eighteen years.

LIST AND DISTRIBUTION OF STANFORD-BINET TESTS

Name of Test	*Groups in Which Test Appears*
Indicating parts of body,	III,1.
Naming objects,	III,2.
Response to pictures,	III,3; VII,2; XII,7.
Stating sex,	III,4.
Stating name,	III,5.
Repeating syllables,	III,6; IV,al.; VI,6; X,al2; XVI,al.1.
Repeating digits forward	III,al.; IV,6; VII,3; X,al.1; XIV,al.; XVIII,3.
Repeating digits backward,	VII,al.2; IX,4; XII,6; XVI,5; XVIII,5.
Comparing lines,	IV,1.
Comparing weights,	V,1.
Discriminating forms,	IV,2.
Counting pennies,	IV,3; VI,3.
Copying geometrical forms,	IV,4; VII,6.
Comprehending questions,	IV,5; VI,4; VIII,3; X,5; XVI,al.2.
Naming colors,	V,2.
Aesthetic judgment,	V,3.
Defining terms,	V,4; VIII,5; XII,2; XVI,3.
Patience,	V,5.
Executing command,	V,6.
Stating age,	V,al.
Indicating right and left,	VI,1.
Missing parts,	VI,2.
Naming coins,	VI,5; VIII,al.1.
Morning or afternoon,	VI,al.
Number of fingers,	VII,1.
Tying bow knot,	VII,4.
Giving differences,	VII,5; XIV,3.
Naming days of week,	VII,al.1.
Ball and field,	VIII,1; XII,3.
Counting backwards,	VIII,2.
Giving similarities,	VIII,4; XII,8.
Vocabulary,	VIII,6; X,1; XII,1; XIV,1; XVI,1; XVIII,1.
Dictation,	VIII,al.2.
Giving date,	IX,1.
Arranging weights,	IX,2.
Making change,	IX,3.
Three words in sentence,	IX,5.
Rhymes,	IX,6.
Months of year,	IX,al.1.
Value of stamps,	IX,al.2.
Absurdities,	X,2.
Memory for designs,	X,3.
Reading and report,	X,4.
Free association,	X,6.
Form board,	X,al.3.
Dissected sentences,	XII 4.
Fables,	XII,5; XVI,2.
Induction test,	XIV,2.
President and king (included under giving difference).	
Problems of fact (included under comprehension of questions).	
Mathematical reasoning,	XIV,5.
Clock test,	XIV,6.

List and Distribution of Stanford-Binet Tests—*Continued*

Name of Test	*Groups in Which Test Appears*
Box problem,	XVI,4.
Code test,	XVI,6.
Binet's paper cutting,	XVIII,2.
Memory for passage,	XVIII,4.
Ingenuity test,	XVIII,6.

This analysis of the Stanford scale serves two purposes,—first, it exhibits the haphazardness of distribution of a given test, the lack of any scientific principle, so far as the placing of a test in particular groups is concerned; and second, it indicates the entire absence of the functional principle in the selection of tests for a particular group.

In view of these characteristics of the Stanford scale, it seems pertinent still further to emphasize the idea of gradation within a given test or measure of behavior. Assuming, as genetic studies certainly warrant us in doing, that the fundamental forms of behavior are present by the end of the third year in their initial stages, it seems logical and scientifically necessary to argue that we should devise methods of measuring these forms of behavior as they develop, and that the most natural and most feasible way to do this is to select a method which can be applied, according to a gradation scheme, to all stages of development. For example, the test of repeating digits may be increased in difficultness without end. It may be applied alike to the child of three and the intellectually mature individual. It may be graded almost perfectly by the addition of single digits. The initial form of the test may require merely the repetition of a digit after the examiner. The most difficult form may, instead, require the repetition of ten digits. Or, the test of response to pictures may be so devised and developed as to be clearly applicable from early childhood to maturity. It needs only a number of carefully selected pictures arranged according to difficultness of description and interpretation. The child of three years may be required merely to indicate certain objects in the pictures, as named by the examiner. The child of four may be required, instead, to name these same objects. Still later, more complete enumeration of the constituents of the pictures may be expected; then description, and interpretation increasingly full and exact with increasing age. Finally, there would be required, as an adequate form of response, correct interpretation and fair to excellent description.

While it may not be assumed that precisely the same forms or aspects of behavior are measured by this test throughout its age range, it is at least evident that more nearly comparable results may be obtained by using the same materials for different ages than by using diverse and heterogeneous materials and procedures.

Neither the Point Scale nor the Binet Scale is perfect or ever will be. But from their ashes may arise a new scale infinitely superior to anything Binet or any of his successors have imagined. I believe that the method of graded tests whose indices of correlation with one another and with varied measures of efficiency in living are definitely known, will steadily gain ground; that the gradation as gradually perfected will lead to increasingly accurate standardization; that there will accumulate reliable and varied norms for the guidance of the inexperienced examiner; and that shortly our scales for mental measurement will consist of independently graded and standardized tests which can be used either alone for the measurement of particular response or in such groups as need dictates.

The next step forward I imagine as a scale in which vertical instead of horizontal divisions will indicate age lines. It will consist of a score or two of thoroughly proved and approved methods of measurement, each so devised that it may be applied at any stage of development. Were there twelve steps or grades of difficultness in each test, then the examiner would begin with the first grade for the three-year-old; with the fifth grade for the eight-year-old; with the ninth grade for the twelve-year-old. Not the scale, but its constituent part, the test, would be marked for convenience of use by age lines. The lines consequently would be vertical instead of horizontal!

THE EVALUATION OF A METHOD FOR FINELY GRADUATED ESTIMATES OF ABILITIES[1]

By JAMES BURT MINER, Carnegie Institute of Technology

Estimating abilities may be merely skirmishing in research, but the attack of the main army is often wisely or foolishly directed as a result of the skirmish. The technique of estimating accordingly assumes an essential place in psychological procedure. Any improvement in the discrimination or reliability of estimates promises to meet urgent needs, not only in the employment office but whenever questions of admission or promotions are considered in the school room, the store, the factory, or the business office.

Our immediate problem was connected with the employment office at the Carnegie Institute of Technology, which recommends students and graduates for positions ranging from civil engineer to actress, from plumber to musician, from architect to teacher. Can the scholarship records be supplemented by sufficiently reliable and significant ratings of personal traits to be of use in recommending these young people for work?

Beginning with the problem of estimating the traits of those about to graduate from the institution, we were at once confronted by the fact that all the seniors were not intimately enough known by one person to make it possible to have an order of merit for the whole class in a college arranged by the same person. This is a frequent problem in estimation. Thorndike has attacked it by a method of combining the judgments of numerous judges.[2] His method, however, requires that each individual in the final order of merit be compared by several judges with those on either side of him, a condition we could not fulfill.

We hoped to obtain sufficient accuracy by assuming that the average senior class in the various courses within the same school had roughly the same distribution of ability. On this assumption a single order of merit might be obtained for the seniors of each school, provided that some systematic method of grading could be discovered which would be used in approximately the same way by the different judges.

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[1] Substantially as read before the American Psychological Association, December, 1916.

[2] E. L. Thorndike. The Technique of Combining Incomplete Judgments of the Relative Position of N Facts by N Judges. *J. of Phil., Psychol.,* etc., 1916, vol. 13, 197-203.

The method which we tried out is indicated by the sample rating blank shown in Fig. 1. At least four of these blanks were prepared for each student in the senior classes and they were sent to members of the faculty who were supposed by the administrative officers to be best acquainted with the particular students. Three out of the four had come in contact with the students in either the laboratory or shop, which afforded them a better opportunity for judgment than is possible in many institutions. The fourth judge was a teacher in one of the academic subjects. In order that no member of the faculty should be burdened we limited the number of students to be graded by any one instructor to about a dozen. About 70 judges graded sub-groups of the 140 seniors.

One feature of the method consisted in grading the person by means of a dot placed on a line. This plan of placing a dot on a line was found in a blank prepared by the B. F. Clark Teachers Agency of Chicago. A somewhat similar plan with five divisions from 0-100, without definition of the meaning of the divisions or of the standard group, was tried at one time by the Appointment Committee at Teachers College, Columbia University. The method was adapted to our purpose by substituting divisions into fifths of a group instead of the divisions "superlative, excellent, satisfactory, fair and poor" which were used on the teachers' agency blank. Psychologically the use of a dot on a line seems to have a decided advantage over the percentage method, which it most closely resembles, in that it gets rid of the habit of thinking that different percentages have qualitative significance as indicating passing or excellent grades.

The blank embodies four fundamental principles for securing systematic estimates which are here combined for the first time, so far as I know. They summarize the result of much of the systematic work which has been done in this field in recent years. (1) The person is rated relative to the members of a defined group which is known by the judges and is used as a standard. In our case the average senior class in the students course and school was used as this standard. (2) All qualitative terms are avoided since it is impossible to define them so that they call up the same idea in the minds of different judges. Instead, we have used fifths of the group, a concept about which there should be no difference in opinion as to what is meant. (3) The method allows the discrimination to be made as finely as the judge desires and yet permits

FIGURE 1.—SAMPLE RATING BLANK

Will you please rate the student named below for the traits indicated. Place a dot along the line after each trait, grading the student as finely as you care to. Please give the rating independently without consulting others. The record sheet is to be returned to the secretary's office within three days.

JONES, JOHN Instructor—D

Among the members of *the average senior class in this student's course and school* the student would rank in the

	Lowest 5th	Fourth 5th	Middle 5th, Average	Second 5th	Highest 5th
Common sense					
Energy					
Initiative					
Leadership					
Reliability					
General Ability					

the investigator to determine approximately how small divisions in that grading have sufficient reliability to make them worth while. The results on this phase of the problem will be discussed later in the paper. (4) The units of measurement may be readily transmuted into equivalent units of the standard deviation on the basis of the distribution of the judgments. In our blank the measurements may be made in millimeters or any larger portion of the line and changed into units of the standard deviation by Thorndike's table.

Just a word as to the choice of the particular traits for use on the blank. A list of something over 300 traits was first compiled from the studies by Cattell, Wells, Yerkes and LaRue, Davenport's Trait Book, Mann's study of engineers, etc. From this list, 50 were selected and submitted to three different groups to be arranged in order of their importance in recommending graduates for employment. These arrangements were made by the members of the seminar in psychology, the three men in the employment office, and a group of seniors and juniors in the teachers' training courses. The result is shown in Table I.

TABLE I

Combined Order of Merit for Traits in Recommending Graduates for Employment

	By all (13)	Q.	Extremes	Seminar (6)	Office (3)	Students (14)
common sense	1	6.5	(1-23)	3.0	2.0	1.0
judgment	2	10.5	(1-45)	8.0	3.0	8.0
initiative	3	6.0	(1-39)	2.0	11.0	9.0
reliability	4	9.5	(1-48)	13.0	13.5	4.0
efficiency	5	8.5	(2-38)	7.0	19.0	6.0
intellect	6	9.0	(1-39)	4.0	6.0	11.0
clearness of thought	7	5.5	(2-44)	9.0	23.0	3.0
understanding of men	8	10.0	(1-47)	22.0	7.5	7.0
accuracy	9	10.5	(2-43)	23.0	35.5	2.0
integrity	10	15.5	(1-47)	16.0	4.0	13.5
energy	11	10.5	(4-43)	5.0	5.0	18.0
technical skill	12	15.0	(1-45)	21.0	21.0	10.0
loyal	13	13.0	(1-46)	12.0	1.0	29.0
industry	14	13.0	(4-47)	1.0	9.5	37.0
moral	15	18.0	(1-49)	31.5	13.5	12.0
resourcefulness	16	7.0	(8-42)	17.0	15.5	5.0
foresight	17	10.0	(7-39)	14.0	26.5	21.0
thorough	18	11.0	(4-48)	28.5	34.0	19.0
conscientiousness	19	12.0	(2-48)	10.0	22.0	27.5
leadership	20	14.0	(1-44)	11.0	15.5	30.0
ambition	21	11.5	(2-47)	26.0	28.0	17.0
perseverance	22	13.0	(3-49)	6.0	42.0	25.0
originality	23	11.0	(4-46)	19.0	25.0	24.0
tact	24	12.5	(7-50)	27.0	20.0	23.0
systematic	25	13.5	(5-47)	33.5	44.5	13.5
self-reliant	26	13.5	(4-47)	15.0	12.0	39.0
concentration	27	10.0	(2-44)	28.5	34.0	19.0
broad-minded	28	16.0	(3-50)	24.5	26.5	26.0
co-operativeness	29	11.0	(9-46)	24.5	17.0	36.0
courage	30	15.5	(3-48)	35.5	7.5	33.0
Imagination	31	12.5	(5-50)	20.0	18.0	38.0
well-informed	32	8.0	(1-49)	38.5	44.5	19.0
stability	33	16.0	(5-48)	37.0	35.5	27.5
careful	34	12.5	(6-48)	43.5	47.0	16.0
practical	35	8.0	(3-48)	40.0	31.5	34.0
enthusiasm	36	6.5	(6-45)	28.5	9.5	41.0
adaptable	37	5.5	(14-48)	33.5	46.0	35.0
memory	38	11.5	(7-49)	49.0	40.0	21.0
patience	39	8.5	(3-49)	31.5	24.0	40.0
observation	40	9.5	(10-50)	47.0	38.0	30.0
quickness	41	7.5	(4-49)	47.0	37.0	32.0
inquiring	42	8.5	(8-48)	41.0	33.0	44.0
aggressive	43	10.5	(11-50)	45.0	29.5	47.0
firmness	44	8.0	(17-48)	43.5	29.5	46.0
oral expression	45	10.0	(5-50)	48.0	39.0	43.0
presence	46	8.5	(1-50)	38.5	31.5	48.0

TABLE I—*Continued*

apprehension	47	10.0	(4-50)	42.0	48.0	45.0
profound	48	5.5	(6-50)	30.0	50.0	50.0
dignified	49	3.5	(23-50)	50.0	49.0	49.0
ease of learning	50	10.0	(5-50)	35.5	43.0	42.0

CORRELATIONS

	(r from R)
Seminar and employment office...............	.57
Seminar and students.......................	.54
Employment office and students..............	.28

Among the traits which were near the top of these lists we then selected five which seemed to represent different important factors in personality from the point of view of employment, and which were not sufficiently indicated by the scholarship records or "General Ability." The latter term allowed the judge to weigh the traits subjectively and to summarize his opinion of the student.

In evaluating the method the first question is, how far may the judgments be relied upon? How sure are we that other capable judges equally acquainted with the individuals would give like estimates? The correlation of series of estimates on the same people seems to offer the best means of answering this question. The data are summarized in Table II, Reliability of Estimates.

TABLE II—RELIABILITY OF ESTIMATES

COLLEGE SENIORS JUDGED BY MEMBERS OF THE FACULTY AT THE CARNEGIE INSTITUTE OF TECHNOLOGY

College	Gen. A.	Com. S.	Init'e	Lead'p	Reliab.	Energy	Av.
College of Applied Science Correlation of ranks Measured in millimeters 1 judgment and 1 other...... (64 cases)	.53	.54	.53	.64	.30	.67	.54
1 judgment and 1 other...... (30-36 cases)	.63	.52	.42	.68	.50	.69	.57
2 judgments and 2 others. ... (30-36 cases)	.76	.62	.67	.77	.71	.78	.72
Measured in fifths 2 judgments and 2 others. ...	.69	.60	.67	.77	.64	.73	.68
Product-Moment cor. of transmuted tenths 2 judgments and 2 others. ... (30-36 cases)	.76	.52	.64	.79	.71	.70	.69

TABLE II—*Continued*

College	Gen. A.	Com. S.	Init'e	Lead'p	Reliab.	Energy	Av.
M.M. College for Women (24-26 cases)							
2 judgments and 2 others. . . . Correlation of ranks measured in m.m.	.44	.59	.69	.79	.61	.70	.64
Product-Moment cor. of transmuted tenths	.44	.62	.68	.80	.69	.62	.64
College of Applied Science (30 cases) Correlation of ranks							
2 judgments in fifths and the same 2 in m.m.	.98	.98	.88	.97	.90	.97	.94
2 judgments in fifths and the same 2 in transmuted tenths	.86	.89	.91	.87	.96	.97	.91

All the correlations are between a series of judgments selected at random from those made on each student and similar series selected in the same way from those judgments remaining. The same series of single judgments or of combined judgments on the same students is always used in the correlations compared, but the judgments are scored in different ways.

The first two rows of figures compared with all the others in the table indicate that a single judgment is not sufficiently reliable, but that two judgments combined give approximately a reliability of 0.7 and may be relied upon when no more judgments are practicable. Four judgments combined, which we use, should then give us a reliability of .83, if we apply William Brown's formula for estimating the number of combined judgments necessary to attain a desired degree of reliability.[3] It is interesting to note that, if the correlation between two single series is .55, as here, the correlation between the two series combined and two other series should theoretically be .71. This agrees with our empirical findings.

In the Margaret Morrison Carnegie School it is possible to check the order of merit for the seniors which has been obtained by combining the estimates of various instructors, none of whom judged the whole class, by two orders of merit for the whole class furnished by the dean and by the secretary of the school who has charge of employment. The orders of merit arranged by each of these administrative officers correlates over .70 with the combined order of merit of the faculty judgments on the "general ability" of various parts of the class, taken from the estimate blanks. The combined order of merit of the administrative officers agrees with the result of the same combined faculty estimate with a correlation of .75. All correlation coefficients for rank orders in Table II are obtained by Pearson's method for calculating P and translating to r.

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[3] The Essentials of Mental Measurements, note, p. 101.

Important data as to the form of scoring these estimates are also provided in Table II. Notice the three rows of coefficients in the second division of the table. The averages are .72, .68 and .69. They suggest that refinements of measurement make very little difference in the reliability of an order of merit obtained from two judgments chosen at random. This is true at least so far as the orders of merit of these thirty seniors in the engineering college were concerned. The results are corroborated by the next two rows of data on the seniors in the college for women, which show the same average, .64. Since four judgments are averaged the students were fairly well discriminated in rank.

The last division of the table, moreover, shows that an order of merit obtained from two judgments combined remains practically the same whether the judgments are scored one way or another. Measurements in fifths give about the same order of merit as those in millimeters or transmtued tenths. The correlations are over .90. If an order of merit is all that is desired, records in less than fifths or the use of transmuted measures are probably unnecessary refinements. When the methods differ as to particular students, however, the refined method may be safer. With our blank the position of the dot can be read directly in tenths as easily as in fifths.

There is some tendency for students in certain divisions to be ranked higher than in others. This may raise the correlations. If present, however, the spurious correlation does not affect our conclusions. In the women's college the order of merit agreed well with that of the two administration officers who ranked the entire class. At least two judgments are necessary for reasonable reliability, and the measurement of combined judgments need not be in smaller units than fifths if conclusions are limited to the group as a whole, rather than directed to particular students.

TABLE III

Intercorrelations of Abilities

Thirty seniors in the College of Applied Science estimated by four judges in tenths of an average graduating class and the scores then transmuted into units of the standard deviation. Scholarship rated by the total scholarship in credit hours transmuted into units of the standard deviation. The correlations were calculated by the product-moment formula.

	Schol'p.	Gen'l. A.	Com. S.	Energy	Init've.	Lead'p.	Reliab.
Scholarship	...	.73	.58	.73	.62	.39	.72
General ability	.73	...	.85	.74	.78	.71	.84
Common sense	.58	.85	...	.68	.76	.68	.78
Energy	.73	.74	.68	...	.78	.46	.76
Initiative	.62	.78	.76	.78	...	.75	.80
Leadership	.39	.71	.68	.46	.75	...	.55
Reliability	.72	.84	.78	.76	.80	.55	...
Average	.62	.78	.72	.69	.75	.59	.74

If the reader will now turn to Table III, the intercorrelations may give us some other hints in evaluating this particular rating card. Which of these specific traits gives the most unique information not afforded by the grades in scholarship? To answer this question we may note which trait shows the lowest correlation with scholarship. With this group of seniors in the engineering college the estimate of "leadership" is least indicated by scholarship. We also note that "general ability" shows the highest intercorrelations with these specific traits, even when we disregard the intercorrelations with scholarship. For a single term "general ability" would, therefore, probably give us the most additional information about the whole group of specific traits. If the problem justified the labor of the calculations this conclusion could be checked by the partial intercorrelation of each of the traits with the others independent of their relations to scholarship.

When considering a particular person, what sort of numerical rating will be most usable? This is largely a question of practical convenience. The method we use is to record the average rating of the faculty judges in a particular trait, then to arrange these in ten equal groups. By this method the rating of the student is in the *actual* tenth of his class in which he fell on the average for that trait. This is, of course, different from the average estimated tenth. For example, the separate judgments of the seniors in the engineering college distributed in the various estimated tenths in general ability as follows, beginning with the estimated lowest tenth and stated in percentages: 2, 3, 8, 3, 9, 29, 17, 8, 15, 6. We may note in passing that the transmuted value in terms of the standard deviations for an estimate in each of these tenths for this college was as follows, omitting decimal points: —24, —18, —14, —11, —8, —3, +3, +7, +11, +20.

In spite of the fact that there is a tendency to place more than a tenth in the middle and upper estimated tenths, the discrimination is probably better than with other methods of estimation. For example, the distribution of the grades in scholarship of the same class under the six marks used showed the following percentages of credit hours for each mark: 1, 7, 15, 54, 19, 4.

A more precise quantitative score also seems advisable, at least for general ability. For this purpose we have used estimated tenths transmuted into terms of the standard deviation. With this quantitative score a unit means approximately the same at one position on the scale as at another. This is not true of decile units or ranks in an order of merit, in which adjacent extreme tenths theoretically differ from each other about three times as much as those tenths near the middle.

The office should also be informed as to the variability of these ratings. For example, with the estimates of general ability of the 64 engineering seniors, we can say that the chances are roughly 9 out of 10 that a student would not be estimated more than 2 tenths of an average class differently, even in the most variable tenths, by a similar average judgment of four members of the faculty.

W. D. Scott has suggested a method by which the rating blank can be made more concrete if comparison can be made to a known group which is stable enough so that typical individuals may be selected for a standard scale. For example, when the divisions are in fifths, at the boundaries of the divisions may be inserted the names of those persons in the standard group who are highest, lowest, middle, etc. The estimator would then judge an individual to be between Mr. A. and Mr. B., or between Mr. B. and Mr. C., etc. In this form the method is being tried out by the Bureau of Salesmanship Research.

The complete answer as to whether it is worth while to supplement the scholarship ratings of college students by such estimates of ability as have been attempted here will be possible only after we can determine whether they assist in making a more accurate prediction of success in life. This must wait until we have data upon these graduates some years after they have left the schools.

That these estimates give illuminating information about certain students cannot be doubted, however, when one finds such records as those of Mr. A. and Mr. B. given in Table IV. Without such estimates of traits, an institution has no systematic record in available form of anything except scholarship. That would certainly be an inadequate basis for judging these individuals. On the other hand it must be recognized that for the great majority of the seniors the estimates and the scholarship records are quite similar. The record of Mr. C. may be said to be fairly typical and that of Mr. D. is the other extreme.

TABLE IV

RECORDS OF INDIVIDUALS

Seniors	Mr. A.	Mr. B.	Mr. C.	Mr. D.
Standard deviation:				
Scholarship	—.24	+.18	+.26	+.82
General ability	+.36	—.30	+.30	+1.40
Actual tenths of the class:				
Scholarship	3	7	7	10
General ability	6	4	6	10
Common sense	8	1	4	10
Energy	8	6	6	10
Initiative	8	4	4	9
Leadership	10	3	7	8
Reliability	7	7	6	10

We may recapitulate the experience of the Carnegie Institute of Technology in regard to the method described above when applied to its seniors in 1916. The empirical test of the method under the conditions found in its four colleges shows: 1. The plan of estimating traits within fifths of an average class in the student's course in college by placing a dot on a line, is so easy to use that replies can be secured, without serious annoyance, from teachers who do not have to estimate more than about a dozen students for six traits. 2. The average of four estimates on each student was found to give fairly constant orders of merit when such estimates on personal traits were made by those as well acquainted with the individuals as instructors in laboratory courses with small groups. An estimate by one member of the faculty is unreliable. 3. The method allows for a quantitative estimate on a common standard without requiring all the members of the class to be known by the same person. 4. The records supplement the scholarship ratings of some students in a most suggestive way. 5. Five traits selected because of their estimated high importance in recommending graduates for employment, were common sense, energy, initiative, leadership and reliability. Among these leadership was least correlated with scholarship ratings. Estimates of general ability showed the highest intercorrelations with the special traits. 6. Scoring the estimates in divisions less than estimated fifths of the class or in transmuted measures did not give notably different orders of merit.

ALTERNATIVE METHODS FOR MENTAL EXAMINERS

FREDERIC LYMAN WELLS, McLean Hospital, Waverley, Mass.

Various types of investigations, particularly those concerned with practise, memory and transfer, demand the use of much alternative material of a homogeneous character. In the type of mental examination represented by the intelligence scales this need has also made itself felt, as a precaution against the vitiation of results through the subject's fore-knowledge, incidental or purposeful, of the test material. In accordance with this situation have been compiled the tables of alternative material to be described. Those dealing with number material include addition, subtraction, multiplication and division, consecutive magnitudes, the reversed clock test, the problem of the enclosed boxes, the "ingenuity" test, a "relational" test with numbers, and memory for digits. Others dealing with language material comprise tables for alphabetical sequence, alternate directions material and vocabulary lists, together with a "cued combination" method for vocabulary and spelling. A simplified form of the Kent-Rosanoff frequency tables in the association test is also included.

As publication of the tables is not now possible, the writer will gladly answer inquiries in regard to experimental material from them. Here is described the present content of the tables, but it is not unlikely that they will be extended to other sorts of experimental material, and suggestions in this regard will be most welcome.

TABLE I. ADDITION-SUBTRACTION

Random drawings of the two place numbers from 11 to 99 inclusive, are grouped in series of 10 numbers each, with no number occurring more than once in each series, and in vertical column, thus:

34
79
87
68
25
82
27
30
24

Fifty such series have been prepared. They may be used either for adding the columns, or for adding (or substracting) a fixed amount from each number (Woodworth-Wells constant increment test).

Table II. Addition-Subtraction

A series of 100 random pairs of six place numbers was prepared. Each pair is given together with its sum. Any pair may be presented as an addition test, in which case the sum checks the correctness of the subject's answer. As a subtraction test, the sum is used as the subtrahend, and either number as the minuend. The other number checks the correctness of the subject's answer. Examples:

1.	683936	859629	1543565
2.	791661	554668	1346329

The table thus provides 100 such examples in addition, and 200 in subtraction.

Table III. Multiplication-Division

A series of 200 random pairs of three place numbers was prepared, in which no digit occurs more than once in the same number. Each pair is given together with its product (after Crelle's tables). If any pair is presented for multiplication, the product checks the correctness of the subject's response. For division, this product is presented to be divided by either of the pair, and the other number checks the correctness of the quotient obtained by the subject. Examples:

1.	384	194	74496
2.	761	257	195577

If, in division, a remainder is desired, its amount is added to the dividend before presenting the problem. The table provides 200 such examples in multiplication and 400 in division.

These tables presenting mathematical problems in the abstract, are of course equally adaptable to any concrete setting in which the examiner may think fit to give them.

Table IV. Consecutive Magnitudes

A series of 1,000 four and five place numbers is presented. The nature of this list safeguards it against duplication except from clerical error. The subject may arrange a small group of the numbers in order of magnitude. The table begins,

8846
8059
10604
10653
10097

Table V. Reversed Clock. (Binet et al.)

The problem is to tell the time indicated if the hands are reversed from that of a given time on the clock. 132 such problems are gathered in 11 columns of 12 each. It is intended that the problems of one experiment shall not be chosen from outside a single column of twelve. The list begins with the times, 3.36, 8.13, 12.41, 10.19.

As both original and reversed times are given in the table, the problem may be given from either one, and the answer checked from the other.

Table VI. Enclosed Boxes. (Terman, Yerkes)

There are given twelve additional problems, based on combinations of 1-4 boxes.

Table VII. "Ingenuity." (Terman, Yerkes)

The principle of the problem is preserved, but its statement altered to the following:

> A doctor must measure out exactly (q) ounces of medicine for a man who is sick in the woods. He has only an (m) ounce measure and an (n) ounce measure to do it with. Show how he can use these measures to get just the right dose of (q) ounces without any guessing. He pours from one measure to the other, and what he does not want he pours back into his medicine bottle.

In the table, the problems are stated by giving first the smaller measure, then the larger measure, and then the amount to be obtained. Thus, 3-5-7 signifies, "3 and 5 to get 7." This problem, the first of those given by Terman and Yerkes, takes five steps for its complete solution. Their second problem, 5-7-8, takes seven steps. By varying these quantities, alternative problems have been prepared, classed as *a* when the larger measure is filled first, and as *b* when the smaller measure is filled first. The number of these alternates for differing degrees of complexity is as follows:

No. steps in solution	3	5	7	9	11	13	15
a—problems.....	17	18	13	11	7	3	1
b—problems......	1	13	14	11	7	3	1

Also one each of 9, 11, 13 and 15 step problems in which either measure is filled first.

The problems may be arranged in series of increasing complexity, care being used that the solution of a shorter problem is not involved in the solution of a longer one. A table of thirty such series is prepared, one of which is:

No. steps...	3	5	7	9	11	13	15
Problem....	7-8-1	7-9-11a	4-5-7b	5-8-12b	4-9-11b	8-9-5b	8-9-4a

In three step problems, the direction to fill a certain measure first may be dispensed with.

Table VIIIa. Mathematical Relations. (After Yerkes' Multiple Choice and Relational Tests)

Tables are prepared adapted to two forms of this test. First, the subject is required to *state* a certain relationship which is thus presented:

What must be done to each of these numbers,	To get these numbers,
289	292
378	381
276	279

The nature and complexity of the relations to be presented is indefinitely variable, and must be decided by the examiner. To facilitate the construction of such test material, the following tables are prepared:

100 random 3-place numbers between 200 and 450
15 2-place and 15 3-place numbers which are multiples of 3
15 2-place and 15 3-place numbers which are multiples of 4
15 2-place and 15 3-place numbers which are multiples of 6
10 2-place and 15 3-place numbers which are multiples of 7
10 2-place and 15 3-place numbers which are multiples of 8
10 2-place and 15 3-place numbers which are multiples of 9

Three examples in 2-place and three examples in 3-place figures of each of the relationships: multiplication and division by 3, 4, 6, 7, 8, 9.

Three examples in 2-place figures of each of the relationships: 2/3, 3/2; 3/4, 4/3; 5/6, 6/5; 6/7, 7/6; 7/8, 8/7; 8/9, 9/8.

Table VIIIb

Second, the subject may be requested to *apply* the relation, with or without its statement. Then a blank is left in a series presented where he is to insert the proper figure. Thus:

232 235 238 241 ......

The tables quoted under VIIIa are also adapted to this form of experiment.

Table IX. Memory for Digits

108 orders of the nine digits are prepared according to these rules: (1) No order to have a figure differing from the preceding figure by 2, 1 or minus 1. (2) No order to have the same difference occurring twice in succession, as 2,5,8; or 9,5,1. (3) In the same group of three orders, no successive orders to have the same figure in the same position. (4)

In the same group of three orders, no two orders to begin or end with the same figures.

For convenience, the digits in each order are divided into groups of three. Thus the first group of this table is, (read horizontally),

286	153	947
749	625	183
851	742	639

This table is equally adapted to the "reversed" repetition of digits (Bobertag, Terman), except that then, differences of plus 2 between successive digits will be involved.

If the conditions are not suitable for the usual type of memory test, a partial substitute (after W. D. Scott) may be had in requiring the subject to transcribe portions of this table, printed at one end of the test form, at the other end, thus,

286153947 ....
749625183 ....
851742639 ....

But in this form of test the rôle of memory is practically absorbed by attention.

TABLE X. ALPHABETICAL SEQUENCE

A list of 1,000 names in random alphabetical sequence is prepared. The constitution of this list does not wholly safeguard it from duplications, but they are practically eliminated. Among the many uses to which such a list may be put, is the arrangement of a small portion of the list in alphabetical order; or better, if responses are written, the indication of this order by prefixing to the names the numbers 1, 2, 3, etc. The table begins,

Foley, Annie E.
Gates, Mary M.
Kennedy, Allan G.
McDonald, Alice D.
Robertson, Clara L.

TABLE XI. DIRECTIONS

The text of the Woodworth-Wells *hard directions* test is so varied as to alter each of the responses called for. The number of alternative responses thus provided varies from 10 to 25 among the 15 directions of the test. The order of their presentation is also varied. In preparing a test form, the choice of each direction, and its place of sequence in the form, is governed by chance, giving an indefinite variety of test forms from the same foundation. Two sample forms are, Put the number 736 before this name of a boy ......John. #Write any letter except *g* just after this comma,...... #If people believe Lincoln was president in the Civil War, cross out what you last wrote; but if it was someone else, put in the number to complete this sentence, "A dog has......feet." #Notice the numbers 2, 9. If iron is heavier than water, write the larger number here......; but if iron is lighter, write the smaller number here...... #Write *no*, no matter whether California is in Asia or not...... #Write again what you last wrote, here...... #Write the first letter of your first name and the second letter of your last name at the beginning of the dotted line............ #Write *yes* if 3 x 3 are 10......; if not, make a cross here...... #Make a figure 3 under any one of these letters F G H I J. #If coal is black, make a figure 8 here......; but if not, tell where the sun sets...... #Make a dash after the longest of these three words, sand cow cattle . #If Thursday comes after Wednesday, make a square here......; but if not, make a circle here...... or two crosses here...... #Give a wrong answer to this question, "How many days are there in the year?"...... #Show by an exclamation point when the days are longer: In summer?...... In winter?...... #Give the correct answer, *yes* or *no* to this question, "Do turtles have shells?" ......

If a square is round, make a figure 3 here......; but if not, tell where the sun sets...... #Write *no* if 3 x 3 are 9......; if not, make a cross here...... #Write again what you last wrote, here...... #Show by a circle when the nights are shorter: In summer?...... In winter? ...... #Write any letter except *e* just after this comma,........ #Write *yes*, no matter whether Egypt is in Africa or not...... #Make a comma after the shortest of these three words, pocket pole gun #Give the right answer to this question, "How many months are there in a year?"...... #If you believe Paris is in Asia, cross out what you last wrote, but if it is somewhere else, put in the number to complete this sentence, "A chicken has......legs." #Notice the numbers 6, 9. If iron is lighter than water write the smaller number here......; but if iron is heavier, write the larger number here...... #Make a dot to the right of any one of these letters F G H I J #Put the number 681 between these names of boys, John Alfred #If Wednesday comes after Tuesday, make a circle here......; but if not, make a square here......or two crosses here...... #Give the correct answer, *yes* or *no*, to this question, "Are tigers fierce animals? ...... #Write the first letter of your first name and the second letter of your last name at the end of the dotted line......................

TABLE XII. VOCABULARY. (AFTER TERMAN, THE MEASUREMENT OF INTELLIGENCE, 1916, pp. 224-231)

Two thousand words not in Terman's standard list of 100 are similarly selected, at random according to their positions in *Webster's Primary Dictionary*. Random drawings from these 2,000 are grouped in 20 series of 100 words each. The words in each series are presented roughly in order of their difficulty, beginning with the easiest.

TABLE XIII. THE METHOD OF CUED COMBINATION

Its purpose is (1) to make the Vocabulary test of Table XII practicable as a group experiment, (2) to serve also as a test of spelling without the examiner's pronouncing the word to be spelled.

In tests of word-combination, the word to be combined is usually left an entire blank. Here the word is not left wholly blank, but a determining cue is given. The extent of this cue should be such that (1) if the word forms a part of the subject's effective vocabulary, he can hardly fail to combine it properly; (2) if he does not know the word, he cannot supply it by guessing. This cueing must be done carefully, and its extent depends somewhat on whether the test is meant primarily for vocabulary or for spelling. In the latter case, only those portions of the word need be omitted where errors in spelling are most apt to occur.

In representing omitted portions of the word, it is sometimes desirable to represent the number of letters omitted, and sometimes not so. In the former case, each letter omitted is represented by a period, thus:

The boy was sucking a big ripe or. . . e

In the latter case, the omitted portion, of whatever length, is represented by a dash, as is usual in combination tests:

A cent is made of co———

Similar brief sentences, with appropriate cues for the word to be supplied in each, are prepared for

(1) The 100 words of Terman's Vocabulary Test. The same methods is now being extended to the 2,000 alternative words of Table XII.

(2) The "100 commonly misspelled words" of Hammond and Herzberg's "Style-Book of Business English," 1916, pp. 113-4. These are cued especially for spelling. Such methods of spelling test relieve the examiner from speaking the words, and the test from errors traceable to this cause. The subject simply fills out the test-form given him. One at the same time tests the ability to use the word correctly, as in testing for vocabulary.

(3) For spelling alone, a mixture of misspelled and correctly spelled words is efficient.[1] Such misspellings as are given by Hammond and Herzberg are listed with other correctly spelled words selected from Table XII. The subject *corrects* the misspellings he notes.

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[1] Cf. Kemble, Standard Tests for Employees, 1916.

TABLE XIV. FREQUENCY TABLES FOR FREE ASSOCIATION. (ABRIDGED FROM KENT AND ROSANOFF)

Since the "median of community"[2] in associative response is not affected by the responses of less frequency than 1%, the original tables of Kent and Rosanoff are reduced to a small fraction of their bulk by eliminating these, and the process of evaluation is also simplified. For the stimulus-word *Dark* the 114 items of the original Kent-Rosanoff table become 7, as follows:

Dark	
76	black
15	bright
28	color
11	*gloomy*
427	light
221	night
22	room

The precision of the method is unaffected.

TABLE XV. TOWNS AND STATES

A list of 400 leading towns and cities of the United States is prepared, containing the two largest towns in each State, and other towns over 15,000 population (together with Lakewood, N. J., and Portsmouth, N. H.), according to census of 1910. The towns included in this list are presented in random order. Any selection of these, preferably not less than 30, is given to the subject, who indicates the State in which the town is situated. When a town is specified for more than one State, (e. g. Jackson), the States specified for it in the table are to be named; (e. g. Mich., Miss., Tenn.). Credit is not given for States not specified in this table, though they may contain a smaller town of the name called for, (e. g. Jackson, N. H.). The table begins,

Muskegon, Mich.
Ansonia, Conn.
Walla Walla, Wash.
Hagerstown, Md.
Leominster, Mass.

This table may be combined with Table X for a convenient associative memory method. Names taken from Table X are attached at random to addresses from the present table, and thus presented to the subject. After a given interval, it is seen if the subject, on being given the names alone, can recollect the address belonging to each.

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[2] Wells, The Question of Association Types. *Psychol. Rev.* 1912. 19, 259.

TABLE XVI. LETTER-SQUARE.

This table consists of 375 random drawings of one of twenty letters, paired with a random drawing of one of ten numbers, thus B 3, Q 8, T 5. There is presented to the subject a figure with 200 squares, designated vertically by letters and horizontally by numbers. The subject (1) gives the letter and number corresponding to five designated squares, (2) marks in a specified way five other squares whose letter and number are given. The table designates combinations of letter and number to be employed. No letter occurs more than once in any line of 15 combinations. In each line of 15, no number occurs more than once in the first 5 combinations or in the second 10 combinations.

A sample test form is,

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	W
1																				
2																				
3		x																		
4																				
5		c																		
6	n																			
7				g																
8																				
9															t					
10																		f		

6. Each of the squares in the diagram above is named according to the letter under which it stands and the number on the same line with it. Thus the square with an x in it is named B3.

Give the letter and number to name the squares which have in them the small letters c......; f......; t......; g......; n......

Put a figure 6 in square W2.
Put a figure 8 in square N4.
Put a figure 2 in square F3.
Put a figure 7 in square G4.
Put a figure 4 in square J7.

Printed forms have been standardized for this experimental material. Each piece of test material, with its written instructions, is not more than 3 inches in height. The width is 7½ inches, or half or quarter thereof, according to space required. Test-forms from the different tables occupy the following portions of a type page 7½ x 9″:

Table I, Addition-Subtraction,	1/12
Table II, Addition-Subtraction,	1/12
Table III, Multiplication-Division,	1/6

Table IV, Consecutive Numbers,	1/12
Table V, Reversed Clock,	1/6
Table VII, Ingenuity,	1/3
Table VIII*a* or *b*, Mathematical Relations,	1/6
Table IX, Memory for Digits, (Transcription),	1/6
Table X, Alphabetical Names,	1/6
Table XI, Directions,	2/3
Table XIII*a*, Cued Combination, (1)	2/3
Table XIII*b*, Cued Combination, (2)	1/3
Table XV, Towns and States, (3)	1/3
Table XVI, Letter-Square,	1/3

Complete test-forms from Tables I-X, also XV, may be presented, recorded and filed on the standard 5 x 3 card; with the remaining tables, results alone are so filable. Slips of fairly heavy paper cut to 5 x 3 size are more convenient in use than cards, and occupy less space when filed.

Forms like those described are conveniently left blank except for the instructions to the subject, and any variation of the test-material entered upon it, from the tables, in printing, multigraph, typewriting or manuscript. The content of the tests is thus changed whenever desired. For individual examinations it is, in most of the tests, efficient to have the instructions (when not verbal) typewritten on a 5 x 3 slip *a*, and the test material on a second slip *b*. A third slip *c* is then clipped adjacent to the experimental material on slip *b* and on the slip *c* the subject records his response. This slip is then filed as his record in the test, while the slips *a* and *b* are available for repeated similar use. This is most convenient in practice and transfer experiments. Where a number of tests are made in this way with a single subject, the record slips may be filed upon larger master-cards (standard sizes up to 14¼ x 9½) or one behind the other in the regular 5 x 3 cabinet, suitably indexed.

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(1) Words 38-70 inclusive, of Terman or alternate Vocabulary Lists.

(2) Seventeen random selections from Hammond and Herzberg's List.

(3) Different composition for 5 x 3 filing.

PSYCHOLOGY AS APPLIED TO THE NATURAL SCIENCES

By A. A. ROBACK, Harvard University.

Ever since positivism has taken a hold on science, there has been a tendency to apply the method employed by the natural sciences to all the sciences, so much so that in some quarters hope is even held out for such an application in the domain of ethics.[1] Owing to this circumstance, one finds it necessary to outline the scope of the term "natural sciences."

It may be stated then, at the outset that the term "natural sciences" as employed in this article is to embrace not only the biological and geological sciences with all their various subdivisions but also, and in fact more particularly so, the physical and exact sciences. In other words, the designation is used broadly enough to include every science depending, for the most part, upon the observation and recording of natural phenomena as well as the mathematical basis underlying their interpretation, while on the other hand, it is sufficiently restricted to exclude the sociological and historical disciplines which should be treated under a different heading. Psychology, in its experimental phase, especially as treated by the behaviourists and allied schools may well come under this rubric; but the very fact that the status of this science is under discussion is sufficient warrant for confining ourselves at present to the various branches of the *Naturwissenschaften* including physics, astronomy, chemistry, geology, mineralogy, and the biological sciences, such as physiology, botany, zoölogy, anatomy, and their various subdivisions. This, however, by no means goes to say that applied psychology, in its present stage, has anything to offer to all the sciences mentioned. But at least the direction may be shown in which any improvement may be expected, and in general, a grouping of the different sciences is convenient, since the principle involved in one of the members of the group is likely to prove fundamental in all. The question before us then, is: In what way can psychology be of service to science in dealing with the observation of natural phenomena?

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[1] The reference here is notably to the movement inaugurated by L. Lévy-Bruhl and Georg Simmel.

It will be noticed that in all other fields, such as law, medicine, pedagogy, etc., applied psychology has both a *negative* and a *positive* contribution to make. It not only points out the obstacles in healing, but it actually offers its services to effect a cure. It not only exposes the flaws in the legal system of to-day, but sets about devising means by which the cause of justice might be furthered, aside from those flaws. In art, we are not only told what to be on our guard against, but we are taught how definitely to enhance the enjoyment of an artistic production. In short, psychology has incorporated itself in the particular pursuit that summoned it. The salesman is making more sales and the physician cures more effectively by dint of their psychological principles. You can not really separate the two while the selling or curing is in operation.

The relation, however, is not so intimate between psychology and science, especially the natural sciences. Here the psychologist does not pretend to lead the naturalist in his investigations, but merely to act as a check. He cannot hope to make the physicist or the astronomer perceive the better, or the quicker or the more, but reminds him only that he must make allowance for certain facts in matters where the minutest detail may make a vast difference as to results. Hence, the conclusion that applied psychology has only a negative value and not a positive, for natural science.

The reason for this deviation of applied psychology from its usual course is obvious. All other departments of human endeavor, to which psychology can be applied, have a *practical* bearing, and their end is utility. Even art aims at enjoyment. Science, however, although eventuating in utility, may yet be taken up for its own sake. It may be true that every discovery is an invention *in potentia*. Yet science would still retain its value even were the discovery the end of the matter. The search after and attainment of a truth per se has a distinct value apart from the exploitation of it in the economic world. We may reach *this* conclusion then that psychotechnics depends as to extent of applicability upon the degree of practical bearing of the department to which it is applied.

There is another reason for this apparent thinness of applied psychology in our field. In all the other subjects there are two phases to the reaction, both falling into the sphere of human activity and human interests. In law it is the court officials trying to bring about a certain state of affairs by means of influence brought to bear on the jury or the accused. In business, the salesman cannot rest content with picking up certain *impressions*, but must give vent to *certain expressions* in order to persuade his prospective customer to make the purchase. The artist, if he is to be successful, must consciously or unconsciously take into consideration principles that operate, or will, in the long run, operate on the mind of man. He may not create anything with a view to pleasing *others*, but surely he must please himself, and in that event, he is really the prototype of the future cultivated public. We have here a purposive or intentional relation.

Now this motor element which presupposes another human being to complete the relation is entirely missing in the natural sciences. But it is precisely this human objective which is missing that gives rise to the positive part of psychotechnics. It is just because the naturalist does *not* make his will felt, does *not* enter into a life-attitude with another personality that there can be no prognostication of a psychological nature.

It is not therefore the fault of applied psychology if it has not the double importance for the natural sciences that it has in medicine or jurisprudence and so on. It is rather to be attributed to the nature of the case, i. e., to the conditions of science in general. On the other hand, however, these conditions must not be regarded as limitations in any way. As a matter of fact, the reverse seems to be true. The exactness of the physical sciences and the growing positivism of the biological sciences are in a large measure due to the lack of the human objective which, if present, would entail variability. Instead, the naturalist enjoys the privilege of studying conditions that are stable, and this fixity of conditions, although it precludes the life-attitude of one personality towards the other, possesses the excellence that we are, at least, *certain* of the results, once results have been obtained—a circumstance that has conduced to the preëminence of the physical sciences.

But there is again the danger of overrating the infallibility of scientific results because of the infallibility of science. That science, as a description of the laws of nature, based on the principle of uniformity does not err is a view that scarcely admits of any doubt; but it is, as a rule, forgotten by the zealots of science that the results of any investigation do not fall ready-made from heaven. They must be attained by men, men of *science*, it is true, but men all the same, and *all* men are fallible.

It has been thought that an observation in the physical world is infinitely more reliable than a psychological observation; and these devotees have failed to recognize that there is no strictly *physical* observation, that every result in physics or chemistry is a psychological process in operation between the subject and object. Far, then, from hoisting up the physical sciences beyond the reach of psychology, we must rather begin with psychology as the starting-point, for *it* is the foundation of all science.

Science, after all, we must remember, is the construction of the scientist. It is artificial since it never brings us into touch with ultimate reality. In the words of Poincaré, *Gorgian* as it may sound, " Not only science cannot teach us the nature of things; but *nothing* is capable of teaching it to us, and if any god knew it, he could not find words to express it,"[2] and Poincaré is by no means an anti-intellectualist. It is pretty well agreed that the objective validity of science consists not in its presenting an exact model of reality so much as in establishing a certain coherence in the world, or as Poincaré puts it, " It consists in relations that are, will become, or will remain common to all thinking beings." It is at this point that psychology picks up the thread and points out that certain relations are not common to all, and now the question is: what constitutes the difference?

We are constantly reminded that reference must be had to the *facts,* as if the facts were reality as it *is,* ultimately and absolutely, and as if these facts did not involve an element of perception and many other factors that come from within, and consequently are not exactly alike for every individual. It is the business of psychology, then, to answer how universal accord could be brought about by the elimination of these disturbing differences; in other words, how we could obviate *not illusions,* but our ignorance of the illusions.

" But is not illusion real " seems to be the gist of a vigorous attempt by Prof. Holt[3] to bring to life again a by-gone doctrine decked in a new garb. Of course there lurks an ambiguity in the contention that illusion is real. That a process has taken place which we, after reflection and comparison, call illusion is something incontrovertible. The disputed point is whether the perception experienced by the observer is apt to fit into a system of relations with perfect congruity. It is the lack of this congruity that determines the illusion. " But does the camera ever lie? " asks the realist triumphantly. This question again is fraught with equivocation. The camera is not active in deceiving us, but we are *deceived* just the same on our own account just as if we might have been deceived by looking at an object with the naked eye. It is not the camera that deceives us, but our senses brought into a certain relation with the camera and the object. A thousand different cameras may give a thousand different impressions, and then we should be obliged to regard each individual impression as a real impression or percept. And if several physicists or astronomers obtained each a different result in their observations, shall we say that all their observations are real?

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[2] Poincaré: " Value of Science," p. 138.

[3] The New Realism, p. 303ff.

The underlying fallacy appears to be, as was already alluded to, the total neglect of the psychological factors. The act of perception is likened to the impression on the camera, as if the lenses in the camera or the mirrors were things grown on the field and not fashioned by man to suit his own retino-cerebral apparatus. It is not realized that when the camera gives us a distorted image of anything, it is not the instrument that is doing the work. It is still we who are using our eyes while the camera acts as a sort of transmitter.

I have gone into this general discussion at such great length because it seems to me that the psychical functions have too frequently been disregarded in the interpretation of phenomena, although the truth of the matter is that the physical is nothing knowable without the instrumentality of the psychical; and since trained observers do occasionally have different data it is clear that we must look to psychology for an authoritative statement, as the difference could not possibly be due to deviations in the objects observed, for that would be precluded by the principle of Uniformity of Nature or Conformity to Law.

Now how can the individual natural sciences learn about their dependence on psychology? To begin with the science that forms the basis of all the physical sciences, mathematics, it might seem as if this is entirely independent of psychology, and in a sense it is true inasmuch as the foundations of mathematics are the same for everybody and as mathematical propositions are to be traced back to the principle of identity.

But in mathematics too there are various theories and doctrines, and some of them at least, involve other principles besides that of identity. As early as 1892, when the term applied psychology, except in connection with pedagogy, would probably have sounded almost as absurd as talking of applied metaphysics, J. McKeen Cattell asserted the rights of psychology in the most authoritative domain of science when he declared at the first meeting of the American Psychological Association that "The assumption made by the mathematicians, that an error is composed of a very large number of comparatively small and independent errors, cannot be admitted by the psychologist. . . . The deductions of Laplace and Gauss are of the greatest importance, but it should not be forgotten that the laws of nature cannot be invented, they must be discovered. It is within the province of psychology to supply physics with the formulae it requires for eliminating errors of observations in special cases."[4]

More recently the Gaussian theory of error has been subjected to further criticism by one of the leading spirits in the new movement of psychology. "To the most elementary presuppositions of the Gaussian Theory of Error" says Marbe in the *Fortschritte der Psychologie,* "belongs the assumption that the variable errors in question have equal probability. The facts show that these assumptions are invalid and the representative of the exact natural sciences and the psychologist would therefore have to be persuaded to trace the errors resulting from psychological principles and eliminate them."[5] Marbe is here referring to the experiments he has undertaken and successfully carried through to establish what he calls the principle of "the uniformity of psychical occurrence." Marbe in his experiments placed several cards before a number of people and asked them each to pick one card out of the few and record it. The results tended towards an astonishing unanimity. When asked to pick out and write down a certain color, most noted down the color red. In the same way if you ask a number of subjects to write down a number between 1 and 10, between 11 and 20, between 21 and 30, 31 and 40, and 41 and 50, the chances are that 5 or the multiple of 5 would be the number chosen, and next come the numbers nearest to 5; the farther away the less preference. These results evince the fact that there is another phase to the problem of probability that mathematicians have not dreamt of. The *a priori* method cannot be applied as long as the probability depends on an agent. To rely entirely upon such a method would be making the reckoning without the host; and it only shows the sagacity of Hume to have included even mathematics under his programme of humanism.[6]

It remained, however, for astronomy to first recognize the significance of psychology for the observatory. Ever since the assistant of the astronomer Maskelyne was dismissed in 1795 for recording stellar transits half a second or so too late, the phrase "personal equation" has come into vogue, and the relations between psychology and astronomy are becoming all the closer as more light is thrown on the subject by further investigation both on the part of astronomers and on the part of psychologists.

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[4] *American Journal of Psychology,* vol. v, 1892-3, pp. 286-287.

[5] Fortschritte der Psychologie, vol. I, 1913, p. 60.

[6] A Treatise of Human Nature, Part III, § 1.

The bearing of psychology on the physical sciences is well brought out by Newcombe in the *Astrophysical Journal*.[7] "A mind," he says, "accustomed to dealing with objects the correct perception of which depends mainly on visual inference, is naturally prone to extend that inference to cases where the conclusion would be illusory. Having this in mind we see that observers trained in different ways may depict the same object very differently."

As an illustration of these words, Newcombe gives the results of experiments conducted by himself to show that the astronomer Lowell of the Lowell Observatory had wrongly interpreted the width of the Martian Canals and had read into his observations things that were not actually there.

The experiment of Newcombe's consisted in observing at a distance of 10 meters a number of lines through transmitted light, 7 mm thick and 30 cm long. The lines were ruled on white fine paper and one of them was continuous while the others were broken at regular intervals by spaces 1 cm and more in length. The results of the observation are noteworthy. At the distance of 10 meters, all the lines seemed to be continuous and uniform. As the distance was diminished the perception of the gaps did not come on suddenly, but by gradual steps. What was judged to be a continuous line up and down the paper was really a short line with a faint shade below it, and what was still more surprising, a paper that was known to have no visible lines upon it when placed in the window showed a system of continuous lines similar to those that had been observed before.

What the cause of this illusion is does not actually concern us here, but its value for the interpretation of astronomical observations is tremendous. Newcombe's experiments led him to conclude that the breadth of the Martian Canals which was thought to be between 2 and 3 miles was really at least 50 miles. It is true that Lowell[8] did not accept Newcombe's conclusions criticising his method, but when he states that the curious phenomenon occurred also to him many years before, the psychological influence in such cases is even all the more confirmed.

In another direction Bauch[9] at the instance of Marbe concluded an investigation on the estimation of very small divisions such as tenths on a dial. He worked with an arrangement that had been expressly got up for the occasion and which consisted of a vernier marked off into tenths in such a way, however, that the divisions were concealed from the view of the observers. After the hand was seen moving between two integers, the observers were asked to give their judgment while the experimenter could verify the actual tenth that the hand had moved to. As a matter of fact it was found that the tenths at the extremes were given preference over those in the middle. The tenths 1, 2, 8, 9, 0 received by far most of the judgments, while the tenths 3, 4, 5, 6 and 7 were more or less neglected. That seems to point again to Marbe's principle of the Uniformity of the Psychical Event and proves that even deviations from the actual facts are governed by certain psychological principles. This preference for the border tenths is sufficient to vitiate the results of the readings where a line may represent a distance of miles. By carrying on such investigations on an extensive scale with a large number of trained observers, it is possible to determine the extent of the deviation from the actual occurrence and so make allowance for it.

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[7] *Astrophysical Journal*, vol. 26, p. 9.

[8] Lowell: *Astrophysical Journal*, 1907. Reply to Newcombe.

[9] Über Beobachtungsfehler in der meteorologischen Praxis, *Fortschritte der Psychologie*, vol. II, 1914, p. 246ff.

Prof. F. M. Urban[10] also undertook a series of experiments of a similar kind, and his results show likewise that there is a certain favoring with some of the numerals in the estimation of short time intervals while others are neglected. Yet the results are not quite the same as those of Bauch. It is quite probable, as Urban is led to believe, that each set of experiments would work out differently according to the conditions, but at least this is certain that in all those observations referred to there is a systematic error quite apart from the mathematical theory of Error.

This main conclusion is corroborated by the findings of Meissner whose results more or less coincide with those of Urban, and on the other hand by Hellmann, Obermayer and Plassmann, whose conclusions are nearer that of Bauch. It was also brought out in those investigations that some have a tendency to overestimate while others underestimate the time interval. Hellmann[11] thinks that in taking the readings of a barometer, thermometer or hygrometer, slips are constantly made. Very frequently a five is read for a ten, and vice versa, as the length of the stroke is not clearly apperceived. After examining the observatory records at Potsdam, Hellmann learnt that the even tenths of the barometers which are marked off in 1-5 degrees appeared a good deal more frequently than the odd tenths. The reason for this was that every reading, except where the hand was seen exactly between the two 1-5 marks, would be apt to be noted as a fifth or even tenth, i. e., $\frac{3\frac{3}{4}}{10}$ would be read as 4-10 instead of 3-10. The same preference for the round number and more general term at the expense of accuracy was marked in the records showing the direction of the wind. The middle points, such as N.N.E., E.N.E., E.S.E. and the 5 others occurred far more rarely than the main directions N., E., W., and S. As Bauch suggested in the case of his own results, the preference may be due to a greater intensity of attention to the main directions.

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[10] *American Journal of Psychology*, vol. XVIII, 1907 pp. 187-193.

[11] Cited in Bauch's Über Beobachtungsfehler, etc., cf. foot note 9.

Another source of danger for the astronomer was pointed out by Plassmann as consisting in not taking the reading at the right moment. He experimented on the estimation of short spaces with a Jensens Pendelquadrant and found that the readings or estimates must be made very quickly, otherwise the pointer or hand would be likely to slide somewhat away from the actual spot after some vacillation.

In the *Zeitschrift für Psychologie,*[12] the same writer reviews a number of errors caused by individual differences in stellar observation. He relates that red stars would appear to him relatively weaker than they did to most other observers. This underestimation of red was worst at the beginning. Gradually that impression would gain in hue, but the feeling of certainty was so lost to the observer that he jotted down the very first thing he was able to see. To show what factors may influence the astronomer he cites the figures for one observer. At one time the zero tenth was recorded 139 times, which means that it occurred the most frequent among all the tenths. Later, however, the zero tenth occurred only 59 times and was by far the least frequently recorded tenth. It was then revealed that the observer had favored the zero tenth and later tried to avoid the preference with the result that he unduly neglected it.

No less instructive is his more recent investigation on periodicity in the variability of the decimal error,[13] in which he shows by tables based on 13 years of observation (1904-1915 inclusive) that (a) the odd tenths on the astronomical clock are apt to be slurred in favor of the even decimal (b) the overemphasized tenths display a decided periodicity effect. The last conclusion, which is amply proven by Plassmann's tables, is an altogether new datum in the psychology of quantitative observation, and is of especial importance for astronomy.

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[12] *Zeitschrift für Psych.*, vol. 49.

[13] J. Plassmann: *Zeitschrift für Psychologie,* vol. LXXVII, Dec. 1916.

Astronomy was the first of the natural sciences to pave the way for applied psychology, but there is no reason why it should be the only science in that group to require the assistance of psychotechnics. Since physics is so much allied to astronomy, it is impossible for the physicist to feel immune from psychological errors, after the astronomer has been shown to be subject to misobservation, misreading, misinterpretation, misrecording and many other mistakes.

One instance which must be borne in mind by physicists is given by Marbe[14] when he says "If the perception of differences is much easier for very slight and very intense stimuli than for those of medium intensity, it would be necessary in physical readings to select the stimuli to be compared from the middle of the intensity scale." This consideration, he goes on to say, would be important in photometry where two lights of great intensity might have to be reduced in a certain relation. Nor can physicists afford to ignore the phenomena of after images, contrast, induction, and so forth.

In a large measure the physicist's work is similar to that of the astronomer. He too has to estimate space and time intervals, take readings, record colors and the like; and so what has been said above under the head of astronomy will largely hold of the application to physics as well. The physicist has even to employ more senses than the astronomer who has nothing to do with the kinaesthetic or tactual sensations. With all the instruments and appliances at his disposal, the physicist still makes use of his senses in the rough work. It is only when in doubt that he really goes into an elaborate examination. The danger, however, is to be found in the countless instances of certainty which may only express a certain feeling, but does not reveal the actual state of affairs.

Practice, of course, is the great asset of the naturalist, and the question may be raised whether continual practice may not make one a better observer. Meissner's results showing that the one observer who was the most constant was also the most experienced seem to point in that direction; but the whole question can have a pedagogical value only. As a matter of fact he who has a leaning for the natural sciences must surely have his powers of observation well developed. The probability is that he is always in practice, and that the institution of such a discipline would be mere child's play and superfluous for him, although it might help the other children who are less endowed, and even here Baade in his "Aussagen über physikalische Demonstrationen," denies that there was any improvement in the attestation ability of the children who had had the benefit of practice and correction. He even goes so far as to say directly that the "occasional apparent instances of improvement must, in part definitely and some of them with great probability, be traced to factors that have nothing whatever to do with practice or the education of the knack for attesting correctly."[15]

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[14] Marbe: *Fortschritte der Psychologie*, vol. 1, 1913.

In chemistry, as far as I know, no work has been done to show the relation between that science and psychology. The only reference to the application of the latter to the former is found in Münsterberg's *Psychotechnik*, and the following sentences are largely a résumé of a paragraph or two of the book.

The chemist, like the physicist, has many objective criteria at his command, it is true, but finally he must resort to his senses; and the senses to which he appeals are even more in number than those the physicist has occasion to employ, for not only must he use his eyes and fingers and possibly the ears, but has also to gain most of his information through the senses of smell and taste. Of course the chemist has his test-tubes and his formulae, but these are no good to him unless he has full possession of all his senses.

In this respect the following quotation from Münsterberg's book is significant. "When the chemist, let us say, finds that the intensity of the sour taste does not altogether correspond to the chemical grade of acidity, it will be due to purely physiological conditions at the surface of the tongue, whereas the after-effect and combination of tastes which is so important for the chemist might readily lead us to the psychophysiological." But that is not enough, we are told a little further. The chemist like the psychologist must be aware of the fact, e. g., "that the perception of humidity may come about through the touch and temperature sensations without there being any objective stimulus of dampness at all; or that the impression of softness could be got from a hard surface if the skin-spot that is brought in contact with it had first been rubbed against a rough surface."[16]

When we come to think of how much pains chemists have taken to know every detail of all the material they employ, while taking no account of their internal instruments, the sense organs, it is astonishing. The time is yet to come when an accident, such as the disagreement of chemists on matters of fact, will lead to the belated recognition of the value of applied psychology for chemistry.

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[15] Baade: Aussagen über phys. Demon., *Zt. für angewandte Psych.*, vol. 4, 1911, p. 281.

[16] Psychotechnik, p. 683.

In geology there are fewer chances of going wrong on the pure data, but to make up for this, there is a great scope for interpretation, and that means that wrong interpretation is just as likely to trap the geologist as the correct one. Where reconstruction plays a great part, as in geology and many branches of zoölogy, one must be on his guard against unwelcome influences such as suggestibility, imagination, and other purely psychological factors which will be mentioned later. It is very easy to mistake certain marks for fossils or footprints, if one has a pet theory that he wishes to be confirmed. It is perhaps well for an Agassiz to reconstruct an animal out of a couple of bones, but how many are there who nourish their extravagant views by making use of doubtful results?

As for geography, topography, and physiography, psychology can do distinct service in this field in spite of the many measuring-instruments that are to guarantee the accuracy of the records. Of course the measuring of mountains by the aid of barometers and trigonometric calculations has all the advantages that modern science could offer, but the traveler has to judge and make estimates at a distance many times under the most unfavorable atmospheric conditions, and it is here that he encounters difficulties, difficulties which psychology might not obviate, but, at least, it would help to make him more circumspect.

Before one is about to examine a particular locality in detail, he must decide beforehand whether it would be of any advantage or expedient to examine that place, and that he must do at a distance, making a number of estimates. His field glasses and other instruments may be of great service to him, but they would not rid him altogether of some illusions. The illusions may be due to the overestimation of the vertical lines as against the horizontal ones or vice versa. They may be caused by incorrect impressions of background, slopes, colors and many other wrong perceptions.

It is interesting to note in this connection that Münsterberg was struck with the singular difficulty in estimating correctly the height of certain points facing the traveler while descending or ascending a slope. This formed the starting-point for an investigation on the Subjective Horizon carried out by Robert MacDougall. According to MacDougall, the plane is "determined by the positions of the observing eye and the perspective focus. Spatial relationship becomes a temporary subjective horizon."[17] In his experiments, MacDougall introduced at one time a descending plane, at another, an ascending plane. The former led to the lowering of the apparent horizon, while the ascending plane did the reverse, i. e., it elevated the horizon. The results seem to explain why the area of a level ground at the foot of a hill when one is descending it is always taken to be an opposing rise.[18] There are a host of other problems that could be taken up in a similar way and worked out in the laboratory for the benefit of the geographical sciences.

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[17] *Harvard Psychol. Studies,* vol. 1,, p.. 166.

There is no need to refer at present to mineralogy or zoölogy and botany in particular. The methods of these vary but little from those of the other natural sciences, and so the conclusions arrived at already might be applied *mutatis mutandis* to the former.

The physician, too, has not a little to learn from psychology. In the "*Psychotechnik*"[19] our attention is drawn to the fact that where slight tumors or swellings appear as symptoms, it may be a serious matter if the physician could not determine their nature and should allow them to develop until it is too late. Of signal importance for the practitioner is also his ability to use the stethoscope and stethometer and go through the percussion in the most satisfactory manner so as not to endanger the life of the patient. The same holds true in measuring the pressure of the blood or in feeling the pulse. Not alone the ears and fingers must be in sound condition, but the physician must not allow himself to be disturbed by psychological factors.

In anthropology Marbe mentions the work of Myers and Rivers among the Torres Islanders. It is difficult, however, to see why anthropology should be called a natural science any more than a psychological. The pure bodily measurements are it is true physical, but they have no value unless psychologically correlated and explained.[20] You can study the structure of any organ without requiring to know anything about the psychology of the organism, but in order to measure the cephalic index of people, you must set out with certain psychological data from the persons you are measuring; for instance, when Boas tells us that the heads of new settlers, in the second generation, tend to take on the shape of the native American heads,[21] the statement is uninforming unless we know the psychological status, the mental make-up of the

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[18] Ibid., 163.

[19] Psychotechnik, p. 685.

[20] Boas ("Psychological Problems in Anthropology," in *American Journal of Psychology*, vol. XXI, 1910), emphasizes this point theoretically; yet it seems he does not adhere to it in practice, as will be seen presently.

[21] F. Boas: The Mind of Primitive Man, Chap. II.

FIGURE I.—SAMPLE RATING BLANK

Will you please rate the student named below for the traits indicated. Place a dot along the line after each trait, grading the student as finely as you care to. Please give the rating independently without consulting others. The record sheet is to be returned to the secretary's office within three days.

JONES, JOHN Instructor—D

Among the members of *the average senior class in this student's course and school* the student would rank in the

	Lowest 5th	Fourth 5th	Middle 5th, Average	Second 5th	Highest 5th
Common sense					
Energy					
Initiative					
Leadership					
Reliability					
General Ability					

the investigator to determine approximately how small divisions in that grading have sufficient reliability to make them worth while. The results on this phase of the problem will be discussed later in the paper. (4) The units of measurement may be readily transmuted into equivalent units of the standard deviation on the basis of the distribution of the judgments. In our blank the measurements may be made in millimeters or any larger portion of the line and changed into units of the standard deviation by Thorndike's table.

Just a word as to the choice of the particular traits for use on the blank. A list of something over 300 traits was first compiled from the studies by Cattell, Wells, Yerkes and LaRue, Davenport's Trait Book, Mann's study of engineers, etc. From this list, 50 were selected and submitted to three different groups to be arranged in order of their importance in recommending graduates for employment. These arrangements were made by the members of the seminar in psychology, the three men in the employment office, and a group of seniors and juniors in the teachers' training courses. The result is shown in Table I.

TABLE I

COMBINED ORDER OF MERIT FOR TRAITS IN RECOMMENDING GRADUATES FOR EMPLOYMENT

	By all (23)	Q.	Extremes	Seminar (6)	Office (3)	Students (14)
common sense	1	6.5	(1-23)	3.0	2.0	1.0
judgment	2	10.5	(1-45)	8.0	3.0	8.0
initiative	3	6.0	(1-39)	2.0	11.0	9.0
reliability	4	9.5	(1-48)	13.0	13.5	4.0
efficiency	5	8.5	(2-38)	7.0	19.0	6.0
intellect	6	9.0	(1-39)	4.0	6.0	11.0
clearness of thought	7	5.5	(2-44)	9.0	23.0	3.0
understanding of men	8	10.0	(1-47)	22.0	7.5	7.0
accuracy	9	10.5	(2-43)	23.0	35.5	2.0
integrity	10	15.5	(1-47)	16.0	4.0	13.5
energy	11	10.5	(4-43)	5.0	5.0	18.0
technical skill	12	15.0	(1-45)	21.0	21.0	10.0
loyal	13	13.0	(1-46)	12.0	1.0	29.0
industry	14	13.0	(4-47)	1.0	9.5	37.0
moral	15	18.0	(1-49)	31.5	13.5	12.0
resourcefulness	16	7.0	(8-42)	17.0	15.5	5.0
foresight	17	10.0	(7-39)	14.0	26.5	21.0
thorough	18	11.0	(4-48)	28.5	34.0	19.0
conscientiousness	19	12.0	(2-48)	10.0	22.0	27.5
leadership	20	14.0	(1-44)	11.0	15.5	30.0
ambition	21	11.5	(2-47)	26.0	28.0	17.0
perseverance	22	13.0	(3-49)	6.0	42.0	25.0
originality	23	11.0	(4-46)	19.0	25.0	24.0
tact	24	12.5	(7-50)	27.0	20.0	23.0
systematic	25	13.5	(5-47)	33.5	44.5	13.5
self-reliant	26	13.5	(4-47)	15.0	12.0	39.0
concentration	27	10.0	(2-44)	28.5	34.0	19.0
broad-minded	28	16.0	(3-50)	24.5	26.5	26.0
co-operativeness	29	11.0	(9-46)	24.5	17.0	36.0
courage	30	15.5	(3-48)	35.5	7.5	33.0
imagination	31	12.5	(5-50)	20.0	18.0	38.0
well-informed	32	8.0	(1-49)	38.5	44.5	19.0
stability	33	16.0	(5-48)	37.0	35.5	27.5
careful	34	12.5	(6-48)	43.5	47.0	16.0
practical	35	8.0	(3-48)	40.0	31.5	34.0
enthusiasm	36	6.5	(6-45)	28.5	9.5	41.0
adaptable	37	5.5	(14-48)	33.5	46.0	35.0
memory	38	11.5	(7-49)	49.0	40.0	21.0
patience	39	8.5	(3-49)	31.5	24.0	40.0
observation	40	9.5	(10-50)	47.0	38.0	30.0
quickness	41	7.5	(4-49)	47.0	37.0	32.0
inquiring	42	8.5	(8-48)	41.0	33.0	44.0
aggressive	43	10.5	(11-50)	45.0	29.5	47.0
firmness	44	8.0	(17-48)	43.5	29.5	46.0
oral expression	45	10.0	(5-50)	48.0	39.0	43.0
presence	46	8.5	(1-50)	38.5	31.5	48.0

TABLE I—*Continued*

apprehension	47	10.0	(4-50)	42.0	48.0	45.0
profound	48	5.5	(6-50)	30.0	50.0	50.0
dignified	49	3.5	(23-50)	50.0	49.0	49.0
ease of learning	50	10.0	(5-50)	35.5	43.0	42.0

CORRELATIONS

	(r from R)
Seminar and employment office	.57
Seminar and students	.54
Employment office and students	.28

Among the traits which were near the top of these lists we then selected five, which seemed to represent different important factors in personality from the point of view of employment, and which were not sufficiently indicated by the scholarship records or "General Ability." The latter term allowed the judge to weigh the traits subjectively and to summarize his opinion of the student.

In evaluating the method the first question is, how far may the judgments be relied upon? How sure are we that other capable judges equally acquainted with the individuals would give like estimates? The correlation of series of estimates on the same people seems to offer the best means of answering this question. The data are summarized in Table II, Reliability of Estimates.

TABLE II—RELIABILITY OF ESTIMATES

COLLEGE SENIORS JUDGED BY MEMBERS OF THE FACULTY AT THE CARNEGIE INSTITUTE OF TECHNOLOGY

College	Gen. A.	Com. S.	Init'e	Lead'p	Reliab.	Energy	Av.
College of Applied Science Correlation of ranks Measured in millimeters							
1 judgment and 1 other (64 cases)	.53	.54	.53	.64	.30	.67	.54
1 judgment and 1 other (30-36 cases)	.63	.52	.42	.68	.50	.69	.57
2 judgments and 2 others. (30-36 cases)	.76	.62	.67	.77	.71	.78	.72
Measured in fifths 2 judgments and 2 others.	.69	.60	.67	.77	.64	.73	.68
Product-Moment cor. of transmuted tenths 2 judgments and 2 others. (30-36 cases)	.76	.52	.64	.79	.71	.70	.69

TABLE II—*Continued*

College	Gen. A.	Com. S.	Init'e	Lead'p	Reliab.	Energy	Av.
M.M. College for Women (24-26 cases) 2 judgments and 2 others. . . . Correlation of ranks measured in m.m.	.44	.59	.69	.79	.61	.70	.64
Product-Moment cor. of transmuted tenths	.44	.62	.68	.80	.69	.62	.64
College of Applied Science (30 cases) Correlation of ranks 2 judgments in fifths and the same 2 in m.m.	.98	.98	.88	.97	.90	.97	.94
2 judgments in fifths and the same 2 in transmuted tenths	.86	.89	.91	.87	.96	.97	.91

All the correlations are between a series of judgments selected at random from those made on each student and similar series selected in the same way from those judgments remaining. The same series of single judgments or of combined judgments on the same students is always used in the correlations compared, but the judgments are scored in different ways.

The first two rows of figures compared with all the others in the table indicate that a single judgment is not sufficiently reliable, but that two judgments combined give approximately a reliability of 0.7 and may be relied upon when no more judgments are practicable. Four judgments combined, which we use, should then give us a reliability of .83, if we apply William Brown's formula for estimating the number of combined judgments necessary to attain a desired degree of reliability.[3] It is interesting to note that, if the correlation between two single series is .55, as here, the correlation between the two series combined and two other series should theoretically be .71. This agrees with our empirical findings.

In the Margaret Morrison Carnegie School it is possible to check the order of merit for the seniors which has been obtained by combining the estimates of various instructors, none of whom judged the whole class, by two orders of merit for the whole class furnished by the dean and by the secretary of the school who has charge of employment. The orders of merit arranged by each of these administrative officers correlates over .70 with the combined order of merit of the faculty judgments on the "general ability" of various parts of the class, taken from the estimate blanks. The combined order of merit of the administrative officers agrees with the result of the same combined faculty estimate with a correlation of .75. All correlation coefficients for rank orders in Table II are obtained by Pearson's method for calculating P and translating to *r*.

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[3] The Essentials of Mental Measurements, note, p. 101.

Important data as to the form of scoring these estimates are also provided in Table II. Notice the three rows of coefficients in the second division of the table. The averages are .72, .68 and .69. They suggest that refinements of measurement make very little difference in the reliability of an order of merit obtained from two judgments chosen at random. This is true at least so far as the orders of merit of these thirty seniors in the engineering college were concerned. The results are corroborated by the next two rows of data on the seniors in the college for women, which show the same average, .64. Since four judgments are averaged the students were fairly well discriminated in rank.

The last division of the table, moreover, shows that an order of merit obtained from two judgments combined remains practically the same whether the judgments are scored one way or another. Measurements in fifths give about the same order of merit as those in millimeters or transmtued tenths. The correlations are over .90. If an order of merit is all that is desired, records in less than fifths or the use of transmuted measures are probably unnecessary refinements. When the methods differ as to particular students, however, the refined method may be safer. With our blank the position of the dot can be read directly in tenths as easily as in fifths.

There is some tendency for students in certain divisions to be ranked higher than in others. This may raise the correlations. If present, however, the spurious correlation does not affect our conclusions. In the women's college the order of merit agreed well with that of the two administration officers who ranked the entire class. At least two judgments are necessary for reasonable reliability, and the measurement of combined judgments need not be in smaller units than fifths if conclusions are limited to the group as a whole, rather than directed to particular students.

TABLE III

INTERCORRELATIONS OF ABILITIES

Thirty seniors in the College of Applied Science estimated by four judges in tenths of an average graduating class and the scores then transmuted into units of the standard deviation. Scholarship rated by the total scholarship in credit hours transmuted into units of the standard deviation. The correlations were calculated by the product-moment formula.

	Schol'p.	Gen'l. A.	Com. S.	Energy	Init've.	Lead'p.	Reliab.
Scholarship	...	.73	.58	.73	.62	.39	.72
General ability	.73	...	.85	.74	.78	.71	.84
Common sense	.58	.85	...	.68	.76	.68	.78
Energy	.73	.74	.68	...	.78	.46	.76
Initiative	.62	.78	.76	.78	...	.75	.80
Leadership	.39	.71	.68	.46	.75	...	.55
Reliability	.72	.84	.78	.76	.80	.55	...
Average	.62	.78	.72	.69	.75	.59	.74

If the reader will now turn to Table III, the intercorrelations may give us some other hints in evaluating this particular rating card. Which of these specific traits gives the most unique information not afforded by the grades in scholarship? To answer this question we may note which trait shows the lowest correlation with scholarship. With this group of seniors in the engineering college the estimate of "leadership" is least indicated by scholarship. We also note that "general ability" shows the highest intercorrelations with these specific traits, even when we disregard the intercorrelations with scholarship. For a single term "general ability" would, therefore, probably give us the most additional information about the whole group of specific traits. If the problem justified the labor of the calculations this conclusion could be checked by the partial intercorrelation of each of the traits with the others independent of their relations to scholarship.

When considering a particular person, what sort of numerical rating will be most usable? This is largely a question of practical convenience. The method we use is to record the average rating of the faculty judges in a particular trait, then to arrange these in ten equal groups. By this method the rating of the student is in the *actual* tenth of his class in which he fell on the average for that trait. This is, of course, different from the average estimated tenth. For example, the separate judgments of the seniors in the engineering college distributed in the various estimated tenths in general ability as follows, beginning with the estimated lowest tenth and stated in percentages: 2, 3, 8, 3, 9, 29, 17, 8, 15, 6. We may note in passing that the transmuted value in terms of the standard deviations for an estimate in each of these tenths for this college was as follows, omitting decimal points: —24, —18, —14, —11, —8, —3, +3, +7, +11, +20.

In spite of the fact that there is a tendency to place more than a tenth in the middle and upper estimated tenths, the discrimination is probably better than with other methods of estimation. For example, the distribution of the grades in scholarship of the same class under the six marks used showed the following percentages of credit hours for each mark: 1, 7, 15, 54, 19, 4.

A more precise quantitative score also seems advisable, at least for general ability. For this purpose we have used estimated tenths transmuted into terms of the standard deviation. With this quantitative score a unit means approximately the same at one position on the scale as at another. This is not true of decile units or ranks in an order of merit, in which adjacent extreme tenths theoretically differ from each other about three times as much as those tenths near the middle.

The office should also be informed as to the variability of these ratings. For example, with the estimates of general ability of the 64 engineering seniors, we can say that the chances are roughly 9 out of 10 that a student would not be estimated more than 2 tenths of an average class differently, even in the most variable tenths, by a similar average judgment of four members of the faculty.

W. D. Scott has suggested a method by which the rating blank can be made more concrete if comparison can be made to a known group which is stable enough so that typical individuals may be selected for a standard scale. For example, when the divisions are in fifths, at the boundaries of the divisions may be inserted the names of those persons in the standard group who are highest, lowest, middle, etc. The estimator would then judge an individual to be between Mr. A. and Mr. B., or between Mr. B. and Mr. C., etc. In this form the method is being tried out by the Bureau of Salesmanship Research.

The complete answer as to whether it is worth while to supplement the scholarship ratings of college students by such estimates of ability as have been attempted here will be possible only after we can determine whether they assist in making a more accurate prediction of success in life. This must wait until we have data upon these graduates some years after they have left the schools.

That these estimates give illuminating information about certain students cannot be doubted, however, when one finds such records as those of Mr. A. and Mr. B. given in Table IV. Without such estimates of traits, an institution has no systematic record in available form of anything except scholarship. That would certainly be an inadequate basis for judging these individuals. On the other hand it must be recognized that for the great majority of the seniors the estimates and the scholarship records are quite similar. The record of Mr. C. may be said to be fairly typical and that of Mr. D. is the other extreme.

TABLE IV

RECORDS OF INDIVIDUALS

Seniors	Mr. A.	Mr. B.	Mr. C.	Mr. D.
Standard deviation:				
Scholarship	−.24	+.18	+.26	+.82
General ability	+.36	−.30	+.30	+1.40
Actual tenths of the class:				
Scholarship	3	7	7	10
General ability	6	4	6	10
Common sense	8	1	4	10
Energy	8	6	6	10
Initiative	8	4	4	9
Leadership	10	3	7	8
Reliability	7	7	6	10

We may recapitulate the experience of the Carnegie Institute of Technology in regard to the method described above when applied to its seniors in 1916. The empirical test of the method under the conditions found in its four colleges shows: 1. The plan of estimating traits within fifths of an average class in the student's course in college by placing a dot on a line, is so easy to use that replies can be secured, without serious annoyance, from teachers who do not have to estimate more than about a dozen students for six traits. 2. The average of four estimates on each student was found to give fairly constant orders of merit when such estimates on personal traits were made by those as well acquainted with the individuals as instructors in laboratory courses with small groups. An estimate by one member of the faculty is unreliable. 3. The method allows for a quantitative estimate on a common standard without requiring all the members of the class to be known by the same person. 4. The records supplement the scholarship ratings of some students in a most suggestive way. 5. Five traits selected because of their estimated high importance in recommending graduates for employment, were common sense, energy, initiative, leadership and reliability. Among these leadership was least correlated with scholarship ratings. Estimates of general ability showed the highest intercorrelations with the special traits. 6. Scoring the estimates in divisions less than estimated fifths of the class or in transmuted measures did not give notably different orders of merit.

ALTERNATIVE METHODS FOR MENTAL EXAMINERS

FREDERIC LYMAN WELLS, McLean Hospital, Waverley, Mass.

Various types of investigations, particularly those concerned with practise, memory and transfer, demand the use of much alternative material of a homogeneous character. In the type of mental examination represented by the intelligence scales this need has also made itself felt, as a precaution against the vitiation of results through the subject's fore-knowledge, incidental or purposeful, of the test material. In accordance with this situation have been compiled the tables of alternative material to be described. Those dealing with number material include addition, subtraction, multiplication and division, consecutive magnitudes, the reversed clock test, the problem of the enclosed boxes, the "ingenuity" test, a "relational" test with numbers, and memory for digits. Others dealing with language material comprise tables for alphabetical sequence, alternate directions material and vocabulary lists, together with a "cued combination" method for vocabulary and spelling. A simplified form of the Kent-Rosanoff frequency tables in the association test is also included.

As publication of the tables is not now possible, the writer will gladly answer inquiries in regard to experimental material from them. Here is described the present content of the tables, but it is not unlikely that they will be extended to other sorts of experimental material, and suggestions in this regard will be most welcome.

TABLE I. ADDITION-SUBTRACTION

Random drawings of the two place numbers from 11 to 99 inclusive, are grouped in series of 10 numbers each, with no number occurring more than once in each series, and in vertical column, thus:

34
79
87
68
25
82
27
30
24
23

Fifty such series have been prepared. They may be used either for adding the columns, or for adding (or substracting) a fixed amount from each number (Woodworth-Wells constant increment test).

TABLE II. ADDITION-SUBTRACTION

A series of 100 random pairs of six place numbers was prepared. Each pair is given together with its sum. Any pair may be presented as an addition test, in which case the sum checks the correctness of the subject's answer. As a subtraction test, the sum is used as the subtrahend, and either number as the minuend. The other number checks the correctness of the subject's answer. Examples:

1.	683936	859629	1543565
2.	791661	554668	1346329

The table thus provides 100 such examples in addition, and 200 in subtraction.

TABLE III. MULTIPLICATION-DIVISION

A series of 200 random pairs of three place numbers was prepared, in which no digit occurs more than once in the same number. Each pair is given together with its product (after Crelle's tables). If any pair is presented for multiplication, the product checks the correctness of the subject's response. For division, this product is presented to be divided by either of the pair, and the other number checks the correctness of the quotient obtained by the subject. Examples:

1.	384	194	74496
2.	761	257	195577

If, in division, a remainder is desired, its amount is added to the dividend before presenting the problem. The table provides 200 such examples in multiplication and 400 in division.

These tables presenting mathematical problems in the abstract, are of course equally adaptable to any concrete setting in which the examiner may think fit to give them.

TABLE IV. CONSECUTIVE MAGNITUDES

A series of 1,000 four and five place numbers is presented. The nature of this list safeguards it against duplication except from clerical error. The subject may arrange a small group of the numbers in order of magnitude. The table begins,

8846
8059
10604
10653
10097

TABLE V. REVERSED CLOCK. (BINET ET AL.)

The problem is to tell the time indicated if the hands are reversed from that of a given time on the clock. 132 such problems are gathered in 11 columns of 12 each. It is intended that the problems of one experiment shall not be chosen from outside a single column of twelve. The list begins with the times, 3.36, 8.13, 12.41, 10.19.

As both original and reversed times are given in the table, the problem may be given from either one, and the answer checked from the other.

TABLE VI. ENCLOSED BOXES. (TERMAN, YERKES)

There are given twelve additional problems, based on combinations of 1-4 boxes.

TABLE VII. "INGENUITY." (TERMAN, YERKES)

The principle of the problem is preserved, but its statement altered to the following:

> A doctor must measure out exactly (q) ounces of medicine for a man who is sick in the woods. He has only an (m) ounce measure and an (n) ounce measure to do it with. Show how he can use these measures to get just the right dose of (q) ounces without any guessing. He pours from one measure to the other, and what he does not want he pours back into his medicine bottle.

In the table, the problems are stated by giving first the smaller measure, then the larger measure, and then the amount to be obtained. Thus, 3-5-7 signifies, "3 and 5 to get 7." This problem, the first of those given by Terman and Yerkes, takes five steps for its complete solution. Their second problem, 5-7-8, takes seven steps. By varying these quantities, alternative problems have been prepared, classed as *a* when the larger measure is filled first, and as *b* when the smaller measure is filled first. The number of these alternates for differing degrees of complexity is as follows:

No. steps in solution	3	5	7	9	11	13	15
a—problems.....	17	18	13	11	7	3	1
b—problems......	1	13	14	11	7	3	1

Also one each of 9, 11, 13 and 15 step problems in which either measure is filled first.

The problems may be arranged in series of increasing complexity, care being used that the solution of a shorter problem is not involved in the solution of a longer one. A table of thirty such series is prepared, one of which is:

No. steps...	3	5	7	9	11	13	15
Problem....	7-8-1	7-9-11a	4-5-7b	5-8-12b	4-9-11b	8-9-5b	8-9-4a

In three step problems, the direction to fill a certain measure first may be dispensed with.

TABLE VIIIA. MATHEMATICAL RELATIONS. (AFTER YERKES' MULTIPLE CHOICE AND RELATIONAL TESTS)

Tables are prepared adapted to two forms of this test. First, the subject is required to *state* a certain relationship which is thus presented:

What must be done to each of these numbers,	To get these numbers,
289	292
378	381
276	279

The nature and complexity of the relations to be presented is indefinitely variable, and must be decided by the examiner. To facilitate the construction of such test material, the following tables are prepared:

100 random 3-place numbers between 200 and 450
15 2-place and 15 3-place numbers which are multiples of 3
15 2-place and 15 3-place numbers which are multiples of 4
15 2-place and 15 3-place numbers which are multiples of 6
10 2-place and 15 3-place numbers which are multiples of 7
10 2-place and 15 3-place numbers which are multiples of 8
10 2-place and 15 3-place numbers which are multiples of 9

Three examples in 2-place and three examples in 3-place figures of each of the relationships: multiplication and division by 3, 4, 6, 7, 8, 9.

Three examples in 2-place figures of each of the relationships: 2/3, 3/2; 3/4, 4/3; 5/6, 6/5; 6/7, 7/6; 7/8, 8/7; 8/9, 9/8.

TABLE VIIIB

Second, the subject may be requested to *apply* the relation, with or without its statement. Then a blank is left in a series presented where he is to insert the proper figure. Thus:

232 235 238 241 ......

The tables quoted under VIIIa are also adapted to this form of experiment.

TABLE IX. MEMORY FOR DIGITS

108 orders of the nine digits are prepared according to these rules: (1) No order to have a figure differing from the preceding figure by 2, 1 or minus 1. (2) No order to have the same difference occurring twice in succession, as 2,5,8; or 9,5,1. (3) In the same group of three orders, no successive orders to have the same figure in the same position. (4)

In the same group of three orders, no two orders to begin or end with the same figures.

For convenience, the digits in each order are divided into groups of three. Thus the first group of this table is, (read horizontally),

286 153 947
749 625 183
851 742 639

This table is equally adapted to the "reversed" repetition of digits (Bobertag, Terman), except that then, differences of plus 2 between successive digits will be involved.

If the conditions are not suitable for the usual type of memory test, a partial substitute (after W. D. Scott) may be had in requiring the subject to transcribe portions of this table, printed at one end of the test form, at the other end, thus,

286153947 ....
749625183 ....
851742639 ....

But in this form of test the rôle of memory is practically absorbed by attention.

TABLE X. ALPHABETICAL SEQUENCE

A list of 1,000 names in random alphabetical sequence is prepared. The constitution of this list does not wholly safeguard it from duplications, but they are practically eliminated. Among the many uses to which such a list may be put, is the arrangement of a small portion of the list in alphabetical order; or better, if responses are written, the indication of this order by prefixing to the names the numbers 1, 2, 3, etc. The table begins,

Foley, Annie E.
Gates, Mary M.
Kennedy, Allan G.
McDonald, Alice D.
Robertson, Clara L.

TABLE XI. DIRECTIONS

The text of the Woodworth-Wells *hard directions* test is so varied as to alter each of the responses called for. The number of alternative responses thus provided varies from 10 to 25 among the 15 directions of the test. The order of their presentation is also varied. In preparing a test form, the choice of each direction, and its place of sequence in the form, is governed by chance, giving an indefinite variety of test forms from the same foundation. Two sample forms are, Put the number 736 before this name of a boy ......John. #Write any letter except *g* just after this comma,...... #If people believe Lincoln was president in the Civil War, cross out what you last wrote; but if it was someone else, put in the number to complete this sentence, "A dog has......feet." #Notice the numbers 2, 9. If iron is heavier than water, write the larger number here......; but if iron is lighter, *write the smaller number here......* #*Write no, no matter whether* California is in Asia or not...... #Write again what you last wrote, here...... #Write the first letter of your first name and the second letter of your last name at the beginning of the dotted line............ #Write *yes* if 3 x 3 are 10......; if not, make a cross here...... #Make a figure 3 under any one of these letters F G H I J. #If coal is black, make a figure 8 here......; but if not, tell where the sun sets...... #Make a dash after the longest of these three words, sand cow cattle . #If Thursday comes after Wednesday, make a square here......; but if not, make a circle here...... or two crosses here...... #Give a wrong answer to this question, "How many days are there in the year?"...... #Show by an exclamation point when the days are longer: In summer?...... In winter?...... #Give the correct answer, *yes* or *no* to this question, "Do turtles have shells?" ......

If a square is round, make a figure 3 here......; but if not, tell where the sun sets...... #Write *no* if 3 x 3 are 9......; if not, make a cross here...... #Write again what you last wrote, here...... #Show by a circle when the nights are shorter: In summer?...... In winter? ...... #Write any letter except *e* just after this comma,........ #Write *yes*, no matter whether Egypt is in Africa or not...... #Make a comma after the shortest of these three words, pocket pole gun #Give the right answer to this question, "How many months are there *in a year?*"...... #*If you believe Paris is in Asia, cross out what you* last wrote, but if it is somewhere else, put in the number to complete this sentence, "A chicken has......legs." #Notice the numbers 6, 9. If iron is lighter than water write the smaller number here......; but if iron is heavier, write the larger number here...... #Make a dot *to the right of any one of these letters F G H I J* #*Put the* number 681 between these names of boys, John Alfred #If Wednesday comes after Tuesday, make a circle here......; but if not, make a square here......or two crosses here...... #Give the correct answer, *yes* or *no*, to this question, "Are tigers fierce animals? ...... #Write the first letter of your first name and the second letter of your last name at the end of the dotted line......................

Table XII. Vocabulary. (After Terman, The Measurement of Intelligence, 1916, pp. 224-231)

Two thousand words not in Terman's standard list of 100 are similarly selected, at random according to their positions in *Webster's Primary Dictionary*. Random drawings from these 2,000 are grouped in 20 series of 100 words each. The words in each series are presented roughly in order of their difficulty, beginning with the easiest.

Table XIII. The Method of Cued Combination

Its purpose is (1) to make the Vocabulary test of Table XII practicable as a group experiment, (2) to serve also as a test of spelling without the examiner's pronouncing the word to be spelled.

In tests of word-combination, the word to be combined is usually left an entire blank. Here the word is not left wholly blank, but a determining cue is given. The extent of this cue should be such that (1) if the word forms a part of the subject's effective vocabulary, he can hardly fail to combine it properly; (2) if he does not know the word, he cannot supply it by guessing. This cueing must be done carefully, and its extent depends somewhat on whether the test is meant primarily for vocabulary or for spelling. In the latter case, only those portions of the word need be omitted where errors in spelling are most apt to occur.

In representing omitted portions of the word, it is sometimes desirable to represent the number of letters omitted, and sometimes not so. In the former case, each letter omitted is represented by a period, thus:

The boy was sucking a big ripe or. . .e

In the latter case, the omitted portion, of whatever length, is represented by a dash, as is usual in combination tests:

A cent is made of co———

Similar brief sentences, with appropriate cues for the word to be supplied in each, are prepared for

(1) The 100 words of Terman's Vocabulary Test. The same methods is now being extended to the 2,000 alternative words of Table XII.

(2) The "100 commonly misspelled words" of Hammond and Herzberg's "Style-Book of Business English," 1916, pp. 113-4. These are cued especially for spelling. Such methods of spelling test relieve the examiner from speaking the words, and the test from errors traceable to this cause. The subject simply fills out the test-form given him. One at the same time tests the ability to use the word correctly, as in testing for vocabulary.

(3) For spelling alone, a mixture of misspelled and correctly spelled words is efficient.[1] Such misspellings as are given by Hammond and Herzberg are listed with other correctly spelled words selected from Table XII. The subject *corrects* the misspellings he notes.

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[1] Cf. Kemble, Standard Tests for Employees, 1916.

Table XIV. Frequency Tables for Free Association. (Abridged from Kent and Rosanoff)

Since the "median of community"[2] in associative response is not affected by the responses of less frequency than 1%, the original tables of Kent and Rosanoff are reduced to a small fraction of their bulk by eliminating these, and the process of evaluation is also simplified. For the stimulus-word *Dark* the 114 items of the original Kent-Rosanoff table become 7, as follows:

Dark	
76	black
15	bright
28	color
11	gloomy
427	light
221	night
22	room

The precision of the method is unaffected.

Table XV. Towns and States

A list of 400 leading towns and cities of the United States is prepared, containing the two largest towns in each State, and other towns over 15,000 population (together with Lakewood, N. J., and Portsmouth, N. H.), according to census of 1910. The towns included in this list are presented in random order. Any selection of these, preferably not less than 30, is given to the subject, who indicates the State in which the town is situated. When a town is specified for more than one State, (e. g. Jackson), the States specified for it in the table are to be named; (e. g. Mich., Miss., Tenn.). Credit is not given for States not specified in this table, though they may contain a smaller town of the name called for, (e. g. Jackson, N. H.). The table begins,

Muskegon, Mich.
Ansonia, Conn.
Walla Walla, Wash.
Hagerstown, Md.
Leominster, Mass.

This table may be combined with Table X for a convenient associative memory method. Names taken from Table X are attached at random to addresses from the present table, and thus presented to the subject. After a given interval, it is seen if the subject, on being given the names alone, can recollect the address belonging to each.

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[2] Wells, The Question of Association Types. *Psychol. Rev.* 1912. 19, 259.

TABLE XVI. LETTER-SQUARE

This table consists of 375 random drawings of one of twenty letters, paired with a random drawing of one of ten numbers, thus B 3, Q 8, T 5. There is presented to the subject a figure with 200 squares, designated vertically by letters and horizontally by numbers. The subject (1) gives the letter and number corresponding to five designated squares, (2) marks in a specified way five other squares whose letter and number are given. The table designates combinations of letter and number to be employed. No letter occurs more than once in any line of 15 combinations. In each line of 15, no number occurs more than once in the first 5 combinations or in the second 10 combinations.

A sample test form is,

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	W
1																				
2																				
3		x																		
4																				
5		c																		
6	n																			
7				g																
8																				
9															t					
10																		f		

6. Each of the squares in the diagram above is named according to the letter under which it stands and the number on the same line with it. Thus the square with an x in it is named B3.

Give the letter and number to name the squares which have in them the small letters c......; f......; t......; g......; n......

Put a figure 6 in square W2.
Put a figure 8 in square N4.
Put a figure 2 in square F3.
Put a figure 7 in square G4.
Put a figure 4 in square J7.

Printed forms have been standardized for this experimental material. Each piece of test material, with its written instructions, is not more than 3 inches in height. The width is 7½ inches, or half or quarter thereof, according to space required. Test-forms from the different tables occupy the following portions of a type page 7½ x 9″:

Table I, Addition-Subtraction,	1/12
Table II, Addition-Subtraction,	1/12
Table III, Multiplication-Division,	1/6

Table IV, Consecutive Numbers,	1/12
Table V, Reversed Clock,	1/6
Table VII, Ingenuity,	1/3
Table VIII*a* or *b*, Mathematical Relations,	1/6
Table IX, Memory for Digits, (Transcription),	1/6
Table X, Alphabetical Names,	1/6
Table XI, Directions,	2/3
Table XIII*a*, Cued Combination, (1)	2/3
Table XIII*b*, Cued Combination, (2)	1/3
Table XV, Towns and States, (3)	1/3
Table XVI, Letter-Square,	1/3

Complete test-forms from Tables I-X, also XV, may be presented, recorded and filed on the standard 5 x 3 card; with the remaining tables, results alone are so filable. Slips of fairly heavy paper cut to 5 x 3 size are more convenient in use than cards, and occupy less space when filed.

Forms like those described are conveniently left blank except for the instructions to the subject, and any variation of the test-material entered upon it, from the tables, in printing, multigraph, typewriting or manuscript. The content of the tests is thus changed whenever desired. For individual examinations it is, in most of the tests, efficient to have the instructions (when not verbal) typewritten on a 5 x 3 slip *a*, and the test material on a second slip *b*. A third slip *c* is then clipped adjacent to the experimental material on slip *b* and on the slip *c* the subject records his response. This slip is then filed as his record in the test, while the slips *a* and *b* are available for repeated similar use. This is most convenient in practice and transfer experiments. Where a number of tests are made in this way with a single subject, the record slips may be filed upon larger master-cards (standard sizes up to 14¾ x 9½) or one behind the other in the regular 5 x 3 cabinet, suitably indexed.

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(1) Words 38-70 inclusive, of Terman or alternate Vocabulary Lists.

(2) Seventeen random selections from Hammond and Herzberg's List.

(3) Different composition for 5 x 3 filing.

PSYCHOLOGY AS APPLIED TO THE NATURAL SCIENCES

By A. A. Rodack, Harvard University.

Ever since positivism has taken a hold on science, there has been a tendency to apply the method employed by the natural sciences to all the sciences, so much so that in some quarters hope is even held out for such an application in the domain of ethics.[1] Owing to this circumstance, one finds it necessary to outline the scope of the term "natural sciences."

It may be stated then, at the outset that the term "natural sciences" as employed in this article is to embrace not only the biological and geological sciences with all their various subdivisions but also, and in fact more particularly so, the physical and exact sciences. In other words, the designation is used broadly enough to include every science depending, for the most part, upon the observation and recording of natural phenomena as well as the mathematical basis underlying their interpretation, while on the other hand, it is sufficiently restricted to exclude the sociological and historical disciplines which should be treated under a different heading. Psychology, in its experimental phase, especially as treated by the behaviourists and allied schools may well come under this rubric; but the very fact that the status of this science is under discussion is sufficient warrant for confining ourselves at present to the various branches of the *Naturwissenschaften* including physics, astronomy, chemistry, geology, mineralogy, and the biological sciences, such as physiology, botany, zoölogy, anatomy, and their various subdivisions. This, however, by no means goes to say that applied psychology, in its present stage, has anything to offer to all the sciences mentioned. But at least the direction may be shown in which any improvement may be expected, and in general, a grouping of the different sciences is convenient, since the principle involved in one of the members of the group is likely to prove fundamental in all. The question before us then, is: In what way can psychology be of service to science in dealing with the observation of natural phenomena?

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[1] The reference here is notably to the movement inaugurated by L. Lévy-Bruhl and Georg Simmel.

It will be noticed that in all other fields, such as law, medicine, pedagogy, etc., applied psychology has both a *negative* and a *positive* contribution to make. It not only points out the obstacles in healing, but it actually offers its services to effect a cure. It not only exposes the flaws in the legal system of to-day, but sets about devising means by which the cause of justice might be furthered, aside from those flaws. In art, we are not only told what to be on our guard against, but we are taught how definitely to enhance the enjoyment of an artistic production. In short, psychology has incorporated itself in the particular pursuit that summoned it. The salesman is making more sales and the physician cures more effectively by dint of their psychological principles. You can not really separate the two while the selling or curing is in operation.

The relation, however, is not so intimate between psychology and science, especially the natural sciences. Here the psychologist does not pretend to lead the naturalist in his investigations, but merely to act as a check. He cannot hope to make the physicist or the astronomer perceive the better, or the quicker or the more, but reminds him only that he must make allowance for certain facts in matters where the minutest detail may make a vast difference as to results. Hence, the conclusion that applied psychology has only a negative value and not a positive, for natural science.

The reason for this deviation of applied psychology from its usual course is obvious. All other departments of human endeavor, to which psychology can be applied, have a *practical* bearing, and their end is utility. Even art aims at enjoyment. Science, however, although eventuating in utility, may yet be taken up for its own sake. It may be true that every discovery is an invention *in potentia*. Yet science would still retain its value even were the discovery the end of the matter. The search after and attainment of a truth per se has a distinct value apart from the exploitation of it in the economic world. We may reach *this* conclusion then that psychotechnics depends as to extent of applicability upon the degree of practical bearing of the department to which it is applied.

There is another reason for this apparent thinness of applied psychology in our field. In all the other subjects there are two phases to the reaction, both falling into the sphere of human activity and human interests. In law it is the court officials trying to bring about a certain state of affairs by means of influence brought to bear on the jury or the accused. In business, the salesman cannot rest content with picking up certain *impressions*, but must give vent to *certain expressions* in order to persuade his prospective customer to make the purchase. The artist, if he is to be successful, must consciously or unconsciously take into consideration principles that operate, or will, in the long run, operate on the mind of man. He may not create anything with a view to pleasing *others*, but surely he must please himself, and in that event, he is really the prototype of the future cultivated public. We have here a purposive or intentional relation.

Now this motor element which presupposes another human being to complete the relation is entirely missing in the natural sciences. But it is precisely this human objective which is missing that gives rise to the positive part of psychotechnics. It is just because the naturalist does *not* make his will felt, does *not* enter into a life-attitude with another personality that there can be no prognostication of a psychological nature.

It is not therefore the fault of applied psychology if it has not the double importance for the natural sciences that it has in medicine or jurisprudence and so on. It is rather to be attributed to the nature of the case, i. e., to the conditions of science in general. On the other hand, however, these conditions must not be regarded as limitations in any way. As a matter of fact, the reverse seems to be true. The exactness of the physical sciences and the growing positivism of the biological sciences are in a large measure due to the lack of the human objective which, if present, would entail variability. Instead, the naturalist enjoys the privilege of studying conditions that are stable, and this fixity of conditions, although it precludes the life-attitude of one personality towards the other, possesses the excellence that we are, at least, *certain* of the results, once results have been obtained—a circumstance that has conduced to the preëminence of the physical sciences.

But there is again the danger of overrating the infallibility of scientific results because of the infallibility of science. That science, as a description of the laws of nature, based on the principle of uniformity does not err is a view that scarcely admits of any doubt; but it is, as a rule, forgotten by the zealots of science that the results of any investigation do not fall ready-made from heaven. They must be attained by men, men of *science*, it is true, but men all the same, and *all* men are fallible.

It has been thought that an observation in the physical world is infinitely more reliable than a psychological observation; and these devotees have failed to recognize that there is no strictly *physical* observation, that every result in physics or chemistry is a psychological process in operation between the subject and object. Far, then, from hoisting up the physical sciences beyond the reach of psychology, we must rather begin with psychology as the starting-point, for *it* is the foundation of all science.

Science, after all, we must remember, is the construction of the scientist. It is artificial since it never brings us into touch with ultimate reality. In the words of Poincaré, *Gorgian* as it may sound, " Not only science cannot teach us the nature of things; but *nothing* is capable of teaching it to us, and if any god knew it, he could not find words to express it,"[2] and Poincaré is by no means an anti-intellectualist. It is pretty well agreed that the objective validity of science consists not in its presenting an exact model of reality so much as in establishing a certain coherence in the world, or as Poincaré puts it, " It consists in relations that are, will become, or will remain common to all thinking beings." It is at this point that psychology picks up the thread and points out that certain relations are not common to all, and now the question is: what constitutes the difference?

We are constantly reminded that reference must be had to the *facts,* as if the facts were reality as it *is,* ultimately and absolutely, and as if these facts did not involve an element of perception and many other factors that come from within, and consequently are not exactly alike for every individual. It is the business of psychology, then, to answer how universal accord could be brought about by the elimination of these disturbing differences; in other words, how we could obviate *not illusions,* but our ignorance of the illusions.

" But is not illusion real " seems to be the gist of a vigorous attempt by Prof. Holt[3] to bring to life again a by-gone doctrine decked in a new garb. Of course there lurks an ambiguity in the contention that illusion is real. That a process has taken place which we, after reflection and comparison, call illusion is something incontrovertible. The disputed point is whether the perception experienced by the observer is apt to fit into a system of relations with perfect congruity. It is the lack of this congruity that determines the illusion. " But does the camera ever lie? " asks the realist triumphantly. This question again is fraught with equivocation. The camera is not active in deceiving us, but we are *deceived* just the same on our own account just as if we might have been deceived by looking at an object with the naked eye. It is not the camera that deceives us, but our senses brought into a certain relation with the camera and the object. A thousand different cameras may give a thousand different impressions, and then we should be obliged to regard each individual impression as a real impression or percept. And if several physicists or astronomers obtained each a different result in their observations, shall we say that all their observations are real?

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[2] Poincaré: "Value of Science," p. 138.

[3] The New Realism, p. 303ff.

The underlying fallacy appears to be, as was already alluded to, the total neglect of the psychological factors. The act of perception is likened to the impression on the camera, as if the lenses in the camera or the mirrors were things grown on the field and not fashioned by man to suit his own retino-cerebral apparatus. It is not realized that when the camera gives us a distorted image of anything, it is not the instrument that is doing the work. It is still we who are using our eyes while the camera acts as a sort of transmitter.

I have gone into this general discussion at such great length because it seems to me that the psychical functions have too frequently been disregarded in the interpretation of phenomena, although the truth of the matter is that the physical is nothing knowable without the instrumentality of the psychical; and since trained observers do occasionally have different data it is clear that we must look to psychology for an authoritative statement, as the difference could not possibly be due to deviations in the objects observed, for that would be precluded by the principle of Uniformity of Nature or Conformity to Law.

Now how can the individual natural sciences learn about their dependence on psychology? To begin with the science that forms the basis of all the physical sciences, mathematics, it might seem as if this is entirely independent of psychology, and in a sense it is true inasmuch as the foundations of mathematics are the same for everybody and as mathematical propositions are to be traced back to the principle of identity.

But in mathematics too there are various theories and doctrines, and some of them at least, involve other principles besides that of identity. As early as 1892, when the term applied psychology, except in connection with pedagogy, would probably have sounded almost as absurd as talking of applied metaphysics, J. McKeen Cattell asserted the rights of psychology in the most authoritative domain of science when he declared at the first meeting of the American Psychological Association that "The assumption made by the mathematicians, that an error is composed of a very large number of comparatively small and independent errors, cannot be admitted by the psychologist. . . . The deductions of Laplace and Gauss are of the greatest importance, but it should not be forgotten that the laws of nature cannot be invented, they must be discovered. It is within the province of psychology to supply physics with the formulae it requires for eliminating errors of observations in special cases."[4]

More recently the Gaussian theory of error has been subjected to further criticism by one of the leading spirits in the new movement of psychology. "To the most elementary presuppositions of the Gaussian Theory of Error" says Marbe in the *Fortschritte der Psychologie*, "belongs the assumption that the variable errors in question have equal probability. The facts show that these assumptions are invalid and the representative of the exact natural sciences and the psychologist would therefore have to be persuaded to trace the errors resulting from psychological principles and eliminate them."[5] Marbe is here referring to the experiments he has undertaken and successfully carried through to establish what he calls the principle of "the uniformity of psychical occurrence." Marbe in his experiments placed several cards before a number of people and asked them each to pick one card out of the few and record it. The results tended towards an astonishing unanimity. When asked to pick out and write down a certain color, most noted down the color red. In the same way if you ask a number of subjects to write down a number between 1 and 10, between 11 and 20, between 21 and 30, 31 and 40, and 41 and 50, the chances are that 5 or the multiple of 5 would be the number chosen, and next come the numbers nearest to 5; the farther away the less preference. These results evince the fact that there is another phase to the problem of probability that mathematicians have not dreamt of. The *a priori* method cannot be applied as long as the probability depends on an agent. To rely entirely upon such a method would be making the reckoning without the host; and it only shows the sagacity of Hume to have included even mathematics under his programme of humanism.[6]

It remained, however, for astronomy to first recognize the significance of psychology for the observatory. Ever since the assistant of the astronomer Maskelyne was dismissed in 1795 for recording stellar transits half a second or so too late, the phrase "personal equation" has come into vogue, and the relations between psychology and astronomy are becoming all the closer as more light is thrown on the subject by further investigation both on the part of astronomers and on the part of psychologists.

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[4] *American Journal of Psychology*, vol. v, 1892-3, pp. 286-287.

[5] Fortschritte der Psychologie, vol. I, 1913, p. 60.

[6] A Treatise of Human Nature, Part III, § 1.

The bearing of psychology on the physical sciences is well brought out by Newcombe in the *Astrophysical Journal.*[7] "A mind," he says, "accustomed to dealing with objects the correct perception of which depends mainly on visual inference, is naturally prone to extend that inference to cases where the conclusion would be illusory. Having this in mind we see that observers trained in different ways may depict the same object very differently."

As an illustration of these words, Newcombe gives the results of experiments conducted by himself to show that the astronomer Lowell of the Lowell Observatory had wrongly interpreted the width of the Martian Canals and had read into his observations things that were not actually there.

The experiment of Newcombe's consisted in observing at a distance of 10 meters a number of lines through transmitted light, 7 mm thick and 30 cm long. The lines were ruled on white fine paper and one of them was continuous while the others were broken at regular intervals by spaces 1 cm and more in length. The results of the observation are noteworthy. At the distance of 10 meters, all the lines seemed to be continuous and uniform. As the distance was diminished the perception of the gaps did not come on suddenly, but by gradual steps. What was judged to be a continuous line up and down the paper was really a short line with a faint shade below it, and what was still more surprising, a paper that was known to have no visible lines upon it when placed in the window showed a system of continuous lines similar to those that had been observed before.

What the cause of this illusion is does not actually concern us here, but its value for the interpretation of astronomical observations is tremendous. Newcombe's experiments led him to conclude that the breadth of the Martian Canals which was thought to be between 2 and 3 miles was really at least 50 miles. It is true that Lowell[8] did not accept Newcombe's conclusions criticising his method, but when he states that the curious phenomenon occurred also to him many years before, the psychological influence in such cases is even all the more confirmed.

In another direction Bauch[9] at the instance of Marbe concluded an investigation on the estimation of very small divisions such as tenths on a dial. He worked with an arrangement that had been expressly got up for the occasion and which consisted of a vernier marked off into tenths in such a way, however, that the divisions were concealed from the view of the observers. After the hand was seen moving between two integers, the observers were asked to give their judgment while the experimenter could verify the actual tenth that the hand had moved to. As a matter of fact it was found that the tenths at the extremes were given preference over those in the middle. The tenths 1, 2, 8, 9, 0 received by far most of the judgments, while the tenths 3, 4, 5, 6 and 7 were more or less neglected. That seems to point again to Marbe's principle of the Uniformity of the Psychical Event and proves that even deviations from the actual facts are governed by certain psychological principles. This preference for the border tenths is sufficient to vitiate the results of the readings where a line may represent a distance of miles. By carrying on such investigations on an extensive scale with a large number of trained observers, it is possible to determine the extent of the deviation from the actual occurrence and so make allowance for it.

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[7] *Astrophysical Journal,* vol. 26, p. 9.

[8] Lowell; *Astrophysical Journal,* 1907. Reply to Newcombe.

[9] Über Beobachtungsfehler in der meteorologischen Praxis, *Fortschritte der Psychologie,* vol. II, 1914, p. 246ff.

Prof. F. M. Urban[10] also undertook a series of experiments of a similar kind, and his results show likewise that there is a certain favoring with some of the numerals in the estimation of short time intervals while others are neglected. Yet the results are not quite the same as those of Bauch. It is quite probable, as Urban is led to believe, that each set of experiments would work out differently according to the conditions, but at least this is certain that in all those observations referred to there is a systematic error quite apart from the mathematical theory of Error.

This main conclusion is corroborated by the findings of Meissner whose results more or less coincide with those of Urban, and on the other hand by Hellmann, Obermayer and Plassmann, whose conclusions are nearer that of Bauch. It was also brought out in those investigations that some have a tendency to overestimate while others underestimate the time interval. Hellmann[11] thinks that in taking the readings of a barometer, thermometer or hygrometer, slips are constantly made. Very frequently a five is read for a ten, and vice versa, as the length of the stroke is not clearly apperceived. After examining the observatory records at Potsdam, Hellmann learnt that the even tenths of the barometers which are marked off in 1-5 degrees appeared a good deal more frequently than the odd tenths. The reason for this was that every reading, except where the hand was seen exactly between the two 1-5 marks, would be apt to be noted as a fifth or even tenth, i. e., $\frac{3\frac{1}{2}}{10}$ would be read as 4-10 instead of 3-10. The same preference for the round number and more general term at the expense of accuracy was marked in the records showing the direction of the wind. The middle points, such as N.N.E., E.N.E., E.S.E. and the 5 others occurred far more rarely than the main directions N., E., W., and S. As Bauch suggested in the case of his own results, the preference may be due to a greater intensity of attention to the main directions.

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[10] *American Journal of Psychology*, vol. XVIII, 1907 pp. 187-193.

[11] Cited in Bauch's Über Beobachtungsfehler, etc., cf. foot note 9.

Another source of danger for the astronomer was pointed out by Plassmann as consisting in not taking the reading at the right moment. He experimented on the estimation of short spaces with a Jensens Pendelquadrant and found that the readings or estimates must be made very quickly, otherwise the pointer or hand would be likely to slide somewhat away from the actual spot after some vacillation.

In the *Zeitschrift für Psychologie,*[12] the same writer reviews a number of errors caused by individual differences in stellar observation. He relates that red stars would appear to him relatively weaker than they did to most other observers. This underestimation of red was worst at the beginning. Gradually that impression would gain in hue, but the feeling of certainty was so lost to the observer that he jotted down the very first thing he was able to see. To show what factors may influence the astronomer he cites the figures for one observer. At one time the zero tenth was recorded 139 times, which means that it occurred the most frequent among all the tenths. Later, however, the zero tenth occurred only 59 times and was by far the least frequently recorded tenth. It was then revealed that the observer had favored the zero tenth and later tried to avoid the preference with the result that he unduly neglected it.

No less instructive is his more recent investigation on periodicity in the variability of the decimal error,[13] in which he shows by tables based on 13 years of observation (1904-1915 inclusive) that (a) the odd tenths on the astronomical clock are apt to be slurred in favor of the even decimal (b) the overemphasized tenths display a decided periodicity effect. The last conclusion, which is amply proven by Plassmann's tables, is an altogether new datum in the psychology of quantitative observation, and is of especial importance for astronomy.

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[12] *Zeitschrift für Psych.*, vol. 49.

[13] J. Plassmann: *Zeitschrift für Psychologie,* vol. LXXVII, Dec. 1916.

Astronomy was the first of the natural sciences to pave the way for applied psychology, but there is no reason why it should be the only science in that group to require the assistance of psychotechnics. Since physics is so much allied to astronomy, it is impossible for the physicist to feel immune from psychological errors, after the astronomer has been shown to be subject to misobservation, misreading, misinterpretation, misrecording and many other mistakes.

One instance which must be borne in mind by physicists is given by Marbe[14] when he says "If the perception of differences is much easier for very slight and very intense stimuli than for those of medium intensity, it would be necessary in physical readings to select the stimuli to be compared from the middle of the intensity scale." This consideration, he goes on to say, would be important in photometry where two lights of great intensity might have to be reduced in a certain relation. Nor can physicists afford to ignore the phenomena of after images, contrast, induction, and so forth.

In a large measure the physicist's work is similar to that of the astronomer. He too has to estimate space and time intervals, take readings, record colors and the like; and so what has been said above under the head of astronomy will largely hold of the application to physics as well. The physicist has even to employ more senses than the astronomer who has nothing to do with the kinaesthetic or tactual sensations. With all the instruments and appliances at his disposal, the physicist still makes use of his senses in the rough work. It is only when in doubt that he really goes into an elaborate examination. The danger, however, is to be found in the countless instances of certainty which may only express a certain feeling, but does not reveal the actual state of affairs.

Practice, of course, is the great asset of the naturalist, and the question may be raised whether continual practice may not make one a better observer. Meissner's results showing that the one observer who was the most constant was also the most experienced seem to point in that direction; but the whole question can have a pedagogical value only. As a matter of fact he who has a leaning for the natural sciences must surely have his powers of observation well developed. The probability is that he is always in practice, and that the institution of such a discipline would be mere child's play and superfluous for him, although it might help the other children who are less endowed, and even here Baade in his "Aussagen über physikalische Demonstrationen," denies that there was any improvement in the attestation ability of the children who had had the benefit of practice and correction. He even goes so far as to say directly that the "occasional apparent instances of improvement must, in part definitely and some of them with great probability, be traced to factors that have nothing whatever to do with practice or the education of the knack for attesting correctly."[15]

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[14] Marbe: *Fortschritte der Psychologie*, vol. 1, 1913.

In chemistry, as far as I know, no work has been done to show the relation between that science and psychology. The only reference to the application of the latter to the former is found in Münsterberg's *Psychotechnik*, and the following sentences are largely a résumé of a paragraph or two of the book.

The chemist, like the physicist, has many objective criteria at his command, it is true, but finally he must resort to his senses; and the senses to which he appeals are even more in number than those the physicist has occasion to employ, for not only must he use his eyes and fingers and possibly the ears, but has also to gain most of his information through the senses of smell and taste. Of course the chemist has his test-tubes and his formulae, but these are no good to him unless he has full possession of all his senses.

In this respect the following quotation from Münsterberg's book is significant. "When the chemist, let us say, finds that the intensity of the sour taste does not altogether correspond to the chemical grade of acidity, it will be due to purely physiological conditions at the surface of the tongue, whereas the after-effect and combination of tastes which is so important for the chemist might readily lead us to the psychophysiological." But that is not enough, we are told a little further. The chemist like the psychologist must be aware of the fact, e. g., "that the perception of humidity may come about through the touch and temperature sensations without there being any objective stimulus of dampness at all; or that the impression of softness could be got from a hard surface if the skin-spot that is brought in contact with it had first been rubbed against a rough surface."[16]

When we come to think of how much pains chemists have taken to know every detail of all the material they employ, while taking no account of their internal instruments, the sense organs, it is astonishing. The time is yet to come when an accident, such as the disagreement of chemists on matters of fact, will lead to the belated recognition of the value of applied psychology for chemistry.

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[15] Baade: Aussagen über phys. Demon., *Zt. für angewandte Psych.*, vol. 4, 1911, p. 281.

[16] Psychotechnik, p. 683.

In geology there are fewer chances of going wrong on the pure data, but to make up for this, there is a great scope for interpretation, and that means that wrong interpretation is just as likely to trap the geologist as the correct one. Where reconstruction plays a great part, as in geology and many branches of zoölogy, one must be on his guard against unwelcome influences such as suggestibility, imagination, and other purely psychological factors which will be mentioned later. It is very easy to mistake certain marks for fossils or footprints, if one has a pet theory that he wishes to be confirmed. It is perhaps well for an Agassiz to reconstruct an animal out of a couple of bones, but how many are there who nourish their extravagant views by making use of doubtful results?

As for geography, topography, and physiography, psychology can do distinct service in this field in spite of the many measuring-instruments that are to guarantee the accuracy of the records. Of course the measuring of mountains by the aid of barometers and trigonometric calculations has all the advantages that modern science could offer, but the traveler has to judge and make estimates at a distance many times under the most unfavorable atmospheric conditions, and it is here that he encounters difficulties, difficulties which psychology might not obviate, but, at least, it would help to make him more circumspect.

Before one is about to examine a particular locality in detail, he must decide beforehand whether it would be of any advantage or expedient to examine that place, and that he must do at a distance, making a number of estimates. His field glasses and other instruments may be of great service to him, but they would not rid him altogether of some illusions. The illusions may be due to the overestimation of the vertical lines as against the horizontal ones or vice versa. They may be caused by incorrect impressions of background, slopes, colors and many other wrong perceptions.

It is interesting to note in this connection that Münsterberg was struck with the singular difficulty in estimating correctly the height of certain points facing the traveler while descending or ascending a slope. This formed the starting-point for an investigation on the Subjective Horizon carried out by Robert MacDougall. According to MacDougall, the plane is "determined by the positions of the observing eye and the perspective focus. Spatial relationship becomes a temporary subjective horizon."[17] In his experiments, MacDougall introduced at one time a descending plane, at another, an ascending plane. The former led to the lowering of the apparent horizon, while the ascending plane did the reverse, i. e., it elevated the horizon. The results seem to explain why the area of a level ground at the foot of a hill when one is descending it is always taken to be an opposing rise.[18] There are a host of other problems that could be taken up in a similar way and worked out in the laboratory for the benefit of the geographical sciences.

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[17] *Harvard Psychol. Studies,* vol. I,, p.. 166.

There is no need to refer at present to mineralogy or zoölogy and botany in particular. The methods of these vary but little from those of the other natural sciences, and so the conclusions arrived at already might be applied *mutatis mutandis* to the former.

The physician, too, has not a little to learn from psychology. In the "*Psychotechnik*"[19] our attention is drawn to the fact that where slight tumors or swellings appear as symptoms, it may be a serious matter if the physician could not determine their nature and should allow them to develop until it is too late. Of signal importance for the practitioner is also his ability to use the stethoscope and stethometer and go through the percussion in the most satisfactory manner so as not to endanger the life of the patient. The same holds true in measuring the pressure of the blood or in feeling the pulse. Not alone the ears and fingers must be in sound condition, but the physician must not allow himself to be disturbed by psychological factors.

In anthropology Marbe mentions the work of Myers and Rivers among the Torres Islanders. It is difficult, however, to see why anthropology should be called a natural science any more than a psychological. The pure bodily measurements are it is true physical, but they have no value unless psychologically correlated and explained.[20] You can study the structure of any organ without requiring to know anything about the psychology of the organism, but in order to measure the cephalic index of people, you must set out with certain psychological data from the persons you are measuring; for instance, when Boas tells us that the heads of new settlers, in the second generation, tend to take on the shape of the native American heads,[21] the statement is uninforming unless we know the psychological status, the mental make-up of the subject. The subject may have become totally assimilated or he may have clung steadfastly to the traditions and culture of his own nationality, and it makes quite a difference as to which it is. A crucial test of the situation would be to compare the children of thoroughly Americanized foreigners with those of unassimilated immigrants of equally long standing. Besides, a certain type is correlated with a certain people showing that the anthropological data are to be guided and confirmed only on the basis of psychology. That, however, is a side issue.

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[18] Ibid., 163.

[19] Psychotechnik, p. 685.

[20] Boas ("Psychological Problems in Anthropology," in *American Journal of Psychology*, vol. XXI, 1910), emphasizes this point theoretically; yet it seems he does not adhere to it in practice, as will be seen presently.

[21] F. Boas: The Mind of Primitive Man, Chap. II.

In addition to the psycho-physiological influences and sources of error, we must not forget the purely psychological factors. Scientists are just as liable to succumb to suggestion even though of an impersonal nature, to lapses of memory, lack of attention, etc., as is the layman. They may have their individual prejudices and, as a consequence, anticipate things they like, or fail to see objects to which they are averse just as much as the ordinary man. Münsterberg observes that some investigators may even be subject to a degree of suggestibility higher than the normal. It is only thus that we can explain the susceptibility of men like Sir Oliver Lodge and Sir William Crookes, to spiritualistic phenomena.

It is clear that the dictum "Know thyself" applies to the natural scientist in just as equal a measure as to any other man, and perhaps more since it is only by knowing himself that he can know his science. In an experimental study of Belief,[22] the fact was revealed that the trained psychologists rated their beliefs more consistently and in general, their results were more satisfactory than others who had acted as subjects. This suggests according to Sumner that the good introspector knows more about what he believes than the poor introspector who states generally what he thinks he believes.

So far we have dealt only with the individual differences or general deviations in particular respects. We must now approach the subject from a slightly different angle. The upshot of all that has been said above is a warning held out to the investigators of natural science, a warning that is sure to be well taken by all scientists. Prognosis here does not hold except in the sense that if one takes heed of the warning, his result will be more accurate than if he did not; but that is a truism. There is no definite forecasting about that.

It is possible, however, to regard scientists as members of a class or group and treat them under the heading of "group psychology." The fact that one is a naturalist means that his psychical equipment is of a similar kind to another who is in the same field. One does not accidentally become a physicist or chemist, as is the case with tradespeople, and even tradespeople have certain features in common that they may have acquired.

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[22] Study of Belief. *Psych. Review*, 1898, vol. 5.

If then such types should really be discerned among the scientists we should gain a great deal not only for collective psychology, but for pedagogy and science as well. The rôle of prognosis here is very marked, for when we do come to the conclusion that X is of such and such a type, we might know just what kind of a science he is most adapted to. We may possibly be able to tell what X's views will be in other branches than his own and so make allowance for the type prejudice. In short we should know just how far to follow a particular investigator and where to stop.

Generally speaking, it seems that types of scientists do exist. The philologist is a different sort of an investigator from the physicist or chemist. The latter are more prone to positivism through metaphysical skepticism. That there is some basis for a division into types can be inferred from the phrase "*Scepticisme du savant*" which is practically identical with positivism. An extensive study of applied biography in the sense that Ostwald's book " Grosse Männer " may be considered, would settle no doubt the question for us. At present one cannot help noticing that our great naturalists seem to avoid the plateau of pure metaphysics and epistemology. Instead, their temperamental skepticism leads them either to soar to the heights of spiritualism or else to precipitate themselves into the abyss of materialism. They scarcely see any middle course open to them. The world of pure concepts has no charm for them.

Is it not characteristic that Huxley, Haeckel, Mach, Hertz, Kirchoff, Verworn, Ostwald, Jacques Loeb should emphasize the materialistic side of philosophy, while again on the extreme opposite we find even more illustrious names from Pascal down to Lodge?

Another classification may be had on the basis of race or nationality. It is said that science has no nationality. This is quite true, but *scientists nevertheless show the distinct characteristics of their people in their works.* That phlegmatic England should produce a Darwin and Wallace, a Newton and a Faraday all of whom would correspond to the classical type of Ostwald's classification, is worthy of mention.

Other divisions have been suggested among the naturalists. In mathematics, Poincaré[23] tells us, there are the logicians who advance only step by step like Méray who even sets about proving that an angle may be subdivided, while on the other hand there is the intuitionist who makes "quick but precarious conquests." It would therefore be very important to know which is which, so that we might benefit by the breadth of view of the latter and the impeccable accuracy of the former.

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[23] Poincaré: Value of Science, p. 15.

Ostwald's division of great men into two types, the classic and the romantic, is also valuable for the same reason. It furthermore gives us a clue to a whole department of cultural and distribution. If the romanticist is the more stimulating, the more interesting of the two, and exercises the greater influence over people, he ought to be the teacher, while the classic type should do all the research and direct the laboratory—work in which accuracy and rigor deserve the premium. Ach's[24] adoption of the old 4 types of temperaments. with the addition of a fifth, the *besonnene* type, may be reduced to Ostwald's two types, although the information Ach gives us on the inner determination of each of the five types must not be neglected in estimating the reliability of a scientist's work. Several other classifications have been proposed, including Buckle's into synthetic and analytic or deductive and inductive types, but the point is not to obtain suitable names so much as to ascertain what psychological factors constitute the differences in the various types.

Nor again does the fact that one belongs predominantly to a certain type detract from his work. The view of Poincaré that the "two sorts of minds are equally necessary for the progress of the world" is beyond question. Since it is not given to every scientist to develop the perfect blend of types, the next best thing is for every one to cultivate the type that is natural to him as well as he can. The division of scientists into types may not have any influence upon the scientists in the way of correction, but it would act as a guiding star in *making decisions* upon the views of others.

We see, therefore, that while earlier in the paper, the psychologist was represented as addressing himself to the scientist with a mere warning, he now does not venture to correct the scientist as to his temperament. Such a course would be neither right nor useful. Cattell in his "Statistical Studies of American Men of Science"[25] aptly remarks that whereas very many complain of having a bad memory or other defect, we seldom find one who deliberately owns up to a defect of judgment. The reason for this difference, I think, is obvious. In the first place, a defect of memory is easily proven, while bad judgment, on the whole, is something that does not readily lend itself to conviction, because there is no definite standard for judgment, in the first instance. Secondly, the faculty of judgment seems to be the *expression of a man,* something he identifies himself with, and so he regards his own judgment as good as the next man's. The same holds true of temperament. Although every man might think it ideal to possess a harmonious combination of both the classic and the romantic temperaments, it need not surprise us, however, that the one of the classic type regards himself as good as the other and vice versa, and with reason.

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[24] Ach: Über den Willensakt und das Temperament, last chapter.
[25] Science, 1906. 3 articles.

In this matter, then, the psychologist has nothing to do with the scientist as representative of his own science. He now gives his results to the world at large; and these results, after the question of types is carefully studied, would have to be more definite than the mere "Beware" he held out to the scientist. He now not only picks a flaw, but states what may actually be expected under the conditions. Here we have a certain prognostication, but here there is also a human objective—the naturalist, since the applied psychologist sets up an interaction between the personality of the naturalist and that of his students. The human relation and prognostication go together as suggested earlier in the paper.

HUMAN ENGINEERING

E. H. Fish; Employment Manager, Norton Company, Worcester, Mass.

This country which for so many years seemed blessed with unlimited resources is finding itself checked for lack of human power. We have perhaps led the world in what are known abroad as "Yankee tricks" in industry and agriculture, which consist for the most part in the application of mechanical devices to work which might otherwise be done by hand.

In spite of this the development of our natural resources has made necessary the importation of great numbers of workers from other countries less fortunate in their natural possessions. We had assimilated the races of Northern Europe and were becoming accustomed to those from the South and even the East, when the World War placed an embargo on these importations.

Previous to that time our treatment of workmen was on a par with the utter wastefulness with which we cut down our forests and mined and cultivated only the richest lands. If a workman decided to leave us on the impulse of the moment, or if a foreman showed favoritism, or was arbitrary and unreasonable we simply shrugged our shoulders, admitted that it was wrong, and went on our way undisturbed, knowing that a dozen men were ready and anxious to step into his place.

Today all this is reversed. Employers are wondering where the workmen are to come from for the natural growth of business, to say nothing of those for large extensions they would like to build. They see still greater difficulty as the country is drawn into the war, and they see no relief with the coming of peace. The rebuilding of what has been destroyed will demand all the labor of those who live to be released from military service. Women who are content to work in shops to relieve the strain of worry about dear ones in the fighting line will return to their natural functions. Men will follow their natural longings and will return to the lands of their youth.

This leaves us only the Chinese and East Indian races from which to draw additional labor. Neither of these races assimilate readily with other races even in this vast melting pot.

Our greatest source of labor lies in making that which we have doubly efficient.

A few years ago this coming need was seen and partially met by a few men under the leadership of Dr. Fred W. Taylor and christened "Scientific Management." Dr. Taylor showed the enormity of the waste due to inefficient methods and incomplete mechanical aids to doing work.

He however almost entirely ignored the human element or at the best dismissed it with the thought that any desired result can be obtained if the worker is given a slight increase in wages.

It is only within the past three years that the great waste due to the thoughtless hiring and discharge of employees has been seriously considered. It was found that men average to stay less than a year on each job. There are approximately 40,000,000 working people in the United States and nearly 50,000,000 changes in work each year each of which calls for a considerable expenditure in training for the new job. The cost in wages lost, in spoiled work, in time of foreman or instructor consumed, ranges from less than ten dollars in the case of a laborer to a thousand dollars or more for men in executive positions. If we assume the average cost of changing jobs to be $25, which is surely conservative, the loss to the country is a round billion dollars each year.

This loss can be reduced. It ought not to be cut down to the point where promotion is discouraged, but there is a large range of inefficiency before that point is reached.

The first essential to stability of employment in any firm is that there shall be a constant and sufficient supply of applications for work so that a proper selection may be made for the various positions which arise.

The best class of men are careful in choosing the place where they will work when circumstances allow it. They are more apt to be influenced by what people who are already working in that plant say to them than they are by advertisements. While advertisements draw considerable number of people they are very apt to draw the class known as floaters and others who are by no means desirable.

From this it is easy to determine that the first essential is that the shop shall be comfortable in both a physical and a mental way. Good, well lighted buildings, as clean as the work allows, well ventilated, warm in winter, cool in summer, plenty of machinery and tools for the comfortable production of work, foremen and associates kindly and just in their action, all make a shop attractive; but even when men are working in a shop where their only contact with each other and the management is through their work, there is danger that each will get wrong impressions of the other. To offset this there is a real necessity of a semi-social contact in which entire democracy is evident. Such activities as ball games, both inter-departmental and outside, dances under proper care, parades and picnics, in which the management and office mingle freely with the shop and which permit of a spirit similar to that found in educational institutions and expressed in shop yells and celebration of victories, have a value which is evidenced by an immediate increase in the number and quality of applicants for jobs, which in itself almost justifies the expense which such things involve.

Having secured an abundant supply of people from whom to select, the next problem is to select the men for the jobs which are required or to find positions in the shop for those who come who are especially likely appearing people. Various methods of selection have been proposed from time to time, varying all the way from palmistry and phrenology to psychological tests. Most of these are reluctantly received by the average employer who still depends on what he chooses to term "common-sense."

Common-sense reduced to scientific terms becomes a matter of judgment from historical records, that is, the assumption is made that a man who has worked at a given kind of work, has been successful at it, will probably be successful in similar work or if he shows signs of initiative and activity coupled with a spirit of co-operation may be expected to hold positions somewhat more important than those which he has held in the past.

Above all things the employer wishes to know what the *attitude* of his employee is toward work. A man whose questions indicate that he does not want to come too early in the morning nor stay too late at night, or who is too particular about the specific kind of work which he shall do, is apt to be looked on with some degree of suspicion. If, on the other hand, the candidate shows that he has thought the matter out and has decided that he wishes to work for the company to which he is applying and is willing to take some sort of a position, even though it might not be the one which he would like, in the belief that he can make it lead him into the kind of a position which he wishes, then it is almost always safe to assume that the company can afford to employ him even though they may have to make an opening for him for the time being.

Knowledge of the work to be done is of varying degrees of importance according to the department or the kind of work which it is expected that he will undertake. In some places it is really more important that the man shall come with an open mind not influenced by previous experience in that particular work and yet in still others it is possible to find men whose training either at school or in a trade school has been such as to make him immediately valuable in many different lines of work.

It is the custom in many places to analyze the jobs in each shop with the idea that the person who is doing the selecting of help will be guided by those analyses. It seems, however, much wiser that no one should be allowed to make a selection of employees who is not sufficiently familiar by actual personal contact with the work which the employee is to be called on to do, so that he can tell without hesitation whether the man who is applying could be expected to do the work successfully or not. In any given concern if the men who are doing the hiring are skilful at the trade which is the most difficult to learn, they will usually find very little difficulty in securing sufficient familiarity with the other trades, so that their selection can be made readily and with a considerable degree of security.

After it is determined that a given applicant has a sufficient knowledge of the work, if any is necessary, the next thing which is sometimes considered is his *activity*. There are of course many positions where an active man will not be contented; there are many positions where all that is required is his presence. He must be able and willing to act when the time comes but the rest of the time he is simply waiting. On the other hand, in manufacturing industries especially, it is necessary that the larger proportion of men have considerable activity. This can be judged in the new candidate by observing the way in which he acts while under question and, barring a tendency on the part of some to a nervous activity temporary or permanent, there is little difficulty in judging this point. Again, an active man will usually show in his records that he has worked the longest on jobs requiring some considerable activity; while the inactive man will also have stayed the longest on jobs which did not require much action.

The *initiative* of the applicant is something which is rather difficult to get at, but it can usually be discovered by engaging the man in conversation and finding out what he does of his own volition. The use which he makes of his leisure time is oftentimes indicative of what he would do if he were in business for himself and what he will do in an emergency for the people who employ him. Here again the amount of initiative must be tempered somewhat by the position which is to be filled, for example a man of high initiative would not be successful as a watchman because he would not be contented there nor will he be contented in work of a routine nature where the repetition is constant.

Again the employer is very much concerned with the probable *loyalty* of his workmen. It is generally accepted that a man who will stand by the concern with which he works is more valuable than the man, no matter how brilliant he may be, who is all the time thinking of ways in which he can get even with his employer. This is, however, easily discovered by inquiring as to his feelings toward previous employers. We of course are willing to allow every man one or two previous employers for whom he has comparatively little use, but if we find that his attitude toward all previous employers is that they did not treat him in the right way, we cannot help but feel that he probably will think the same of us.

Courtesy is another element of really considerable importance. While it may seem as though a man working at a lathe or bench might be fully as valuable to us even though he were discourteous, at the same time the efficiency of the shop as a whole is lowered by too great a number of men who are habitual grouches. A shop where everybody is feeling good natured can be keyed up to pretty rapid production without tiring the men or without their feeling that they are in any way being driven, while a shop which is not good natured, where the people are all the time suspicious of each other and of the firm, cannot be expected to manifest nearly the efficiency of the other.

Sobriety. It goes without saying in these days that no employer wishes to have any of his men under the influence of liquor either while they are in the shop or at any other time, because we all realize now that a man is stupefied to some extent even by what is known as moderate drinking, that is, if a man is a habitual small drinker and is capable and well esteemed it is pretty certain that if he could be persuaded to abstain entirely he would be of much more value to his employer. Sobriety can only be judged by past records except as the man may be thrown off his guard somewhat when he is asked about it. Any man who is asked whether he is a drinking man or not will usually indignantly reply that he is not, whereas if he is asked what he drinks or how often he takes a drink it is very possible that he may tell the truth without thinking about it.

We also wish to be certain that whomever we employ is a *booster* rather than a knocker. The man who runs down everybody with whom he has had relations, who slurs the absent from work without notice and sicknesses should be followed up by some one representing the employer who will take an interest, which will not however be paternal in any sense, in the man's welfare. This interest is surely a business one and one which after a little time becomes accepted by both the company and the employee as a matter of fact and nothing to be at all surprised about. It is the kind of interest which the employer himself took years ago when his organization was small enough so that he was personally acquainted with all of his subordinates.

A great deal is being done to *improve safety* in our shops. Much of it is prompted in spite of the considerable expense incurred, by the compensation acts in different states, but it has an equally important bearing on the relations of the company to its employees and their length of service. It has been found that less than one-quarter of all the accidents which occur are preventable by means of mechanical safe-guards, but it is necessary that they shall be furnished as an evidence of good faith on the part of the employer, showing the workmen that it is his intention to do his part towards making work safe. Almost all men and especially those with families will greatly prefer to work in a shop that has the reputation of being safe, but a large part of real safety work consists in educating the men, all of them, in safe practises, and it is a part of the duty of a Safety Engineering Department to discover safe practises which are rapid and easily performed so that production is not decreased, for both men and employers are equally concerned that rapidity of production is as great as is consistent with good quality of work and long life of the employee and the machinery which he uses.

Other problems which confront the employer who finds it profitable to have his factory removed from the center of the population are those relating to *transportation, housing,* and *feeding.* It may be generally accepted that an employee considers his working day as lasting from the time he leaves his home in the morning until he returns at night and his idea of whether he is receiving good pay is based on the length of those hours rather than on the hours which he spends inside of the shop. Rapid and comfortable methods of getting back and forth from home to the shop then have a really considerable bearing on the rate of pay which is given. This involves three items; getting from work to the cars or whatever means of transportation is offered, quickly and easily, which often means that trains or cars must be run directly into the yard of the company so that the shortest space of time is used inside of the works. Then, securing of seating capacity or nearly enough seating capacity to take care of all employees, especially when they are coming out in the morning and when they may lose considerable of their productive ability through becoming tired before they are able to work at all. The rapidity with which the cars move to their destination and the distribution of the men to their homes is particularly important, that is, a factory established in the outskirts of a town which has a good transfer system is better than one whose employees are simply dropped at a central point and must walk considerable distances to their homes.

Housing is of great importance because we realize that men who are able to secure suitable accommodations for themselves alone or for their families, if they have them, within walking distance from the work are very much more apt to become permanent members of an organization. It must be taken into consideration, however, that mere furnishing of housing facilities is not enough. The houses must be sufficiently varied in their architecture and in such surroundings as are attractive. The typical mill village of New England does not appeal to the class of people whom we desire. Again, it is necessary that any community shall have its opportunity for amusement. A village some distance from a large city which affords no moving pictures, no libraries, no dances, no socials, no soda fountain or any of the things which are attractive to both young and old cannot compete with a location nearer to the center of a large population.

Another matter which vitally affects those who are located away from the center of population is the *feeding* of their employees. A cold lunch brought from home is probably less expensive than any other meal which will keep a workman alive during the working day, but the low cost is often imaginary because it does not take into consideration the time spent in putting it up or the waste in strength from not having proper food in the middle of the day. Among brain workers it is an open question whether it would not be better to almost entirely omit the mid-day meal and consolidate the whole time in continuous work, but among those whose work is largely physical, it seems to be necessary that a division should be made and that enough food should be taken to renew the strength which was brought to the shop in the morning. The fatigue periods about 10:00 to 11:00 o'clock in the morning and 4:00 to 5:00 o'clock in the afternoon are quite readily noted and are being met in several places now by the installation of what are named "milk stations" or places where milk, buttermilk or some beverage like ginger-ale can be purchased at cost or near it. While these fatigue periods occur at about that time, it is probably wise to keep these stations open from comparatively early in the morning until the latter part of the afternoon. Experience with these stations indicates that men do not abuse them, for they are largely patronized by men who are working at piece rates and who would not go to them if they did not feel that their production was advanced by so doing. Again, it is found that only a very small proportion of the people who use these stations take more than three drinks per day; the large majority taking two, one in the morning and one in the afternoon. It is also found that the very great majority of people drink either milk or buttermilk and only a comparatively few take ginger-ale or anything which is not highly nutritive. In some places chewing gum and chocolate is also sold, the chewing gum to take the place of snuff which is so often chewed in the shop, and the chocolate because it is both candy and food. The effect of such serving of milk during working hours has been quite noticeable in cutting down the amount of liquor men have gone out after. At the regular meal times there seems to be a decided advantage in giving men an opportunity to secure something warm in the form of a stew or a soup, or at least, hot coffee. This is of course particularly noticeable in the winter months when the additional nutrition is necessary. It is also wise to have the men go to certain eating places rather than allow them, as many will if they can, to hide themselves in corners and behind machinery so as to keep away from each other rather than congregating together. The little danger that there might be in having large numbers of men come together in one eating place that those among them who were in any way disgruntled, would start dissension which would spread among them may be offset by furnishing music or moving pictures or other entertainment of similar kind.

It is however, necessary that people be given the kind of food which they ought to have for the sake of building up their strength and also the kind of food which they desire and to which they have become accustomed through long habits. Some employers have even taken such an advanced position in this as to declare that it would be cheaper for them to *give* their employees the proper kind of food if they would eat it, than to *sell* them the kind which they wish to buy. Here again the effect is psychological, because people who are accustomed to eating large quantities of food do not feel themselves sufficiently well sustained unless their already distended organs are filled to the maximum, so that it is necessary to furnish them with a considerable amount of chaff in proportion to the nutriment offered.

As suggested in the earlier parts of this article, in almost every industry considerable numbers of men must be employed who have had no previous experience in that industry. Various attempts have been made by the schools to supplement this work by furnishing trained mechanics. In some lines where the methods of a great number of shops are very much alike it is possible to give *fundamental training* which is equally applicable in all. On the other hand, there are great numbers of men who are employed in industries where the work is not merely practised in different ways in different shops but where the processes in each shop are each considered secret, and it is utterly impossible for the schools to find out what the employers wish their trained help to do. In all such instances as this where it is necessary either through lack of men sufficiently well trained or because the processes are different from those in other shops, it is necessary that the shop shall furnish its own *training department.* More often than not, however, this training is scattered promiscuously through the works and through the office and little or no attention is paid to it, because the owners do not recognize that their establishment is to a very great extent an educational institution.

If records are kept which indicate the men who are hired purposely to become learners, that is, men who do not bring with them specific training that is of value to the company, then it becomes evident that separate training courses are extremely desirable. These training courses may range all the way from one for operatives in a shop in which the men are taught a single operation and are expected to follow that to the exclusion of others during the time which they work for the company, up to those which involve a varied experience in different departments of the shop and in the office and which call for special training and special instructors for a given service. It has been found that men who are thus given a thorough opportunity to learn and know the work which they are expected to do and to know the reason why what is expected of them is required are very much more inclined to stay for long periods of time with the company which has paid that much attention to them. In other words, it appears to be provable that it is very much worth while to spend considerable sums of money in training men for the work which they are to do and also giving them a thorough insight into the relation of that work to the work which is done by others so that, in a measure they become a portion of the company, understanding and comprehending its aims and aspirations.

Many firms have placed much faith in *life insurance* for their employees. The good intentions back of this movement and the very evident economy of insurance at wholesale rates should be provocative of good results. On the other hand, the cash value of such small policies as most firms have seen fit to issue is so small that workmen could hardly afford to lose a chance to earn more money elsewhere. There appears to be a feeling on the part of workmen that life insurance as offered by employers is a kind of bait which they distrust. This is not strange when we consider how much time and effort is necessary to convince well educated men to take out insurance.

Pensions also have a negligible effect on the present problem. They are so long deferred that they have no appeal to an employee during the part of his life when he is most productive.

Unfortunately, in spite of all our best endeavors men are leaving our industrial concerns in large numbers at all times, and it becomes necessary in order to reduce this large flow through our work to discover the *reason why people leave* and what may be done to cure them. In order to do this it is not enough to know the reason why the foreman in charge of a given room thinks his men left him, it is necessary to interview the man and to interview him in such a way that he feels confident that we are not inquiring into his personal affairs but that we have a real interest in his welfare and in those of the rest of our employees. Above all, it is necessary that every man who leaves shall, so far as possible, do it with a good taste in his mouth and in the belief that the company has seriously endeavored to treat him as it should.

Very often it is found, after making a study of the reasons why men leave a given department, that much of it is due to some cause which can be easily remedied, or, in other instances, causes which will be expensive to remedy but which the large number of men leaving and the cost of training new men fully justifies. For example, if it is known that during a given year a thousand men leave a certain department and it costs $50 each to train others to take their places, it is readily seen that an investment of several thousand dollars may be made in improving conditions in that department and still expect a very handsome return for the money expended. Such things however, when left merely to guess work and impression, are apt to have very little weight with the powers who have the spending of money.

Finally, a few men in every shop prove to have been unsuitable men or have changed their ways so that it is necessary to *dispense* with their services. This, however, is one of the things which should never be done in anger or in haste, but the men should understand that the action of their foreman in this same respect is subject to review, and if the foreman has been unjust, he will be persuaded to do what is right. When it is first proposed that the foreman's discharge shall not be final but that it shall be subject to review by some one else, there is apt to be a feeling among them that the sole prerogative which makes it possible for them to maintain discipline has been taken away. Experience, however, has proved that this is not so and that the foreman is in no wise handicapped but rather is aided because it makes it necessary or desirable for him to think twice before he takes this hasty action. It, of course, is necessary that the foreman be convinced of the error of his judgment before a man is reinstated in his department whom he has once requested be dismissed; but since the larger part of our troubles are due to the result of misunderstanding, if there is provided a neutral party, like an employment department, to which appeal can be taken, it is likely that misunderstandings will be readily straightened out and a much better feeling will prevail.

Fluctuation in employment has a most dangerous effect upon the men employed. If it becomes known in any shop or department that people have been discharged or laid off for lack of work, it is very probable that such a discharge will be followed by many resignations from people who are afraid to stay longer for fear that their turn will come next and who attempt to secure employment elsewhere where they have a feeling that their tenure will be longer. It seems to be a very wise thing in hiring people if it is known that their employment is only temporary that it shall be distinctly so understood at the start, and that everybody else in the department shall understand it that way so that when it becomes necessary to reduce the force, these people may be dispensed with without any upsetting of the feelings of others. Again, it is almost impossible for any man to accomplish as much if he sees the pile of work dwindling away and not being replenished. Under such circumstances, it is very easy for almost any workman to reduce his efficiency by even 50% without its being noticed by a foreman. Therefore, it seems very desirable and necessary that so far as possible fluctuation should not be allowed in a department beyond those which are taken care of by the natural flow of men through the works. That is, if it is necessary that a given department should be reduced in numbers, it can usually be done by simply ceasing to hire new people and waiting for those who would naturally leave to get through.

From what has gone before, it may be readily judged that *the work of the employment manager is one which really* comprises a study of human nature all the way from the manager to the lowest paid worker. It seems to be very largely a question of knowing or judging what given individuals or groups of individuals will do under a given set of circumstances, and knowing from experience, which seems to be about our only guide as yet, what people have done under such circumstances, provide suitable means so that the circumstances and what follows from them may go along the line which will bring the greatest profit to the company employing the men. Temporary methods of stimulating production through bonuses or any other of the methods which have been proposed seem to be of comparatively little value in the long run, as men work after all, by the life-time rather than by the day. What we need to know is how much a man can accomplish from the time he should be entering the industry until the time when he should leave it. We cannot afford for the sake of making an apparently low record of turn-over from our shop to put up the bars in any way against promotion, nor can we afford to stand in the way of any one of our employees who finds a better opportunity in the work in the employ of our neighbors and our competitors. If he does find something better, we have only to look to ourselves and to discover what made it possible for him to better his condition there. It seems as if it should be possible for every plant to offer to its employees every opportunity for advancement or self-development while working under different foremen and heads of departments so that they would secure much of the variety which is obtained by working in different shops.

THE ATTITUDE AND THE REACTION OF THE BUSINESS MAN TO PSYCHOLOGY

Editorial Introduction. If psychology is to be of real service to workers in fields of practical activity, it seems essential that there should be the closest coöperation between these practical workers and the scientific investigators of the problems of psychology. Not only must the investigator make his findings more accessible to the world at large, but it is also important that the concrete problems of daily life, especially such as arise in the various fields of business and industrial activities, should be brought to the attention of the expert psychologist. Heretofore each business concern has attempted to solve its psychological problems in an off-hand way, and its solutions of these problems have been only provisional and tentative. In order to indicate to our readers what is the practical business man's attitude toward applied psychology, the editors have approached a number of leaders in the industrial and business world with the request that they give us an expression of their views regarding their problems and the methods they have developed in dealing with 'the human element,' or regarding any other aspect of applied psychology which seems to them to be of prime importance. We hope that the generous responses so far received, several of which are herewith presented, will stimulate others to do likewise; and that the discussion, which we hope will be continued in subsequent numbers of the Journal, will lead to a clearing-up of the various problems involved in the study of mental life as it manifests itself in our everyday activities.

THE HUMAN ELEMENT IN BUSINESS

By Professor HENRY C. METCALF, Tufts College, Mass.

The fundamental problem of the business world is the problem of men living and working together in reasonable harmony and progressive efficiency. Modern machinery as applied to the business world has caught us all in a meshwork of abstract power that has become dangerous. The crude, selfish era of industry from which we are now struggling to emerge has brought society to the most perilous situation in our history. Machinery has broken the brotherhood bond. This human bond must be restored in industry if society is to hold together. The commercialization of the human being must be counteracted. Abstract business power must be made not only scientific but human. This means a vast amount of reorganization, readjustment, regeneration and redemption. It means a proper understanding of man as *man* and a scientific comprehension of the whole problem of the human relations in industry. It means a full understanding of man's physical normal desires and needs—his physical wholeness—it calls for a clear perception of the meaning of his larger life which brings him into relation with his employer and fellow workmen—his organization fitness—it means a knowledge of his social body, which brings him into relation with society as an organism. It means an understanding of the spiritual which is the only real. In other words, the fundamental organic unity of the worker and his organic progress in industry; the organic unity of the plant or firm in which he works; the organic unity of all business and the organic relations between business and humanity at large, must be understood and made a concrete asset before true harmony and real efficiency can be firmly established in business.

Now this is clearly a far vaster problem than any narrow school program can cover. Technical routine training for the various jobs, for transfer and progression within the business, for executive positions, is vital and necessary; but these are not the *real problems* confronting business, nor can these be successfully solved until men learn the fine art of *living together*.

The vital problem in business to-day is to develop growth in the capacity for, and to establish the machinery for practice in the habits of co-operation. This is the *internal problem of problems* confronting business to-day. To its successful solution all possible energy should be given. Everything else is subordinate to this. It calls for the most careful scientific self-analysis, self-direction, and self-control that all the forces of the business world are capable of commanding. To discover the men and to establish, maintain, advance and defend the vision, the ideals, the machinery and the interests for bringing this co-operation about is the great opportunity of organizations such as the National Association of Corporation Schools and the Employment Managers Groups. Business must get down to the great elemental truths of human nature. All the outward, heterogeneous complexity growing out of material and man's relation thereto must be brought into harmony and efficiency by the power of this unifying, inner living principle of co-operative adjustment. The truth in organic unity must comprehend and harmonize the confusing, balking and maiming multiplicity. Business is now crying out for the guidance of unified truth which governs numberless facts—a living, dynamic principle which shall liberate man's body, mind and soul. To make this ideal a reality in business is to awaken in every employee an eager desire to improve the quality of his *own* labor, which is the best asset any business can have.

Logically, therefore if such organizations as the National Association of Corporation Schools, and the Employment Managers Groups are to hold their well-earned leadership in the solution of the great problem of the human interpretation of industry, they must understand the organic nature of man and come to regard the business machinery as the greatest opportunity for the discovery, adaptation, instruction and training, protecting and justly rewarding human talents—in a word, as a vast capacity-catching and capacity-developing mechanism.

THE PSYCHOLOGY OF EFFICIENCY

By G. G. McCHESNEY, Librarian, Pierce-Arrow Motor Car Co.,
Buffalo, N. Y.

The human interest element in industry may be a new phrase, but it certainly is a crying need in the industrial world to-day.

Is there no inspiration in labor? Must the man who works go on forever in a deadly routine, fall into the habit of mechanical nothingness, and reap the reward of only so much drudgery and so much pay? I think not. The times demand an industrial prophet who will lift industry off from its rusted, medieval hinges and put pure human interest, and simple, free-spirited life into modern workmanship. Nothing but human interest will ever awaken a task interest in the ordinary workman. "One of the inevitable results," says Charles L. Pearson, "of increased efficiency in manufacturing processes is the specialization of operations, increased monotony and more intense concentration on the part of the worker. Many manufacturing operations are continual repetitions with no decided change from one lot of work to another, the operator making a few different moves in rapid succession and repeating the operation all day or, perhaps day after day without much change. This class of work requires more or less intense concentration." A deadly monotony must inevitably follow. To put life into this death is the problem. Ever the source of life is life. Neither from the task nor from the machinery nor from the product, nor any other mechanical motive, can come any relief. Human interest alone can inspire a task interest. At the very point where the deadly monotony crucifies the task interest, must a living spirit resurrect a spirit and an interest superior to the monotony of the task. How is it to be done?

The very first element in an efficient management or an efficient supervision is the power to create interest. Is this too difficult? Walter Dill Scott says that the attitude of every man in an organization is the reflection of the dominating factor in the organization. To every workman there is a fascination in an interesting and interested leadership. Interest, like measles, is catching. The thing we would like to know is the psychological source of interest in the average workman. And we contend that you can no more inspire, resurrect, or create interest in a task by an absentee management or a supervision by proxy, or by cardboard, any more than you can hatch chickens from nutmegs. If efficiency is ever to take on real serious character and be measured, not by whim, or guess or conceit, but by living results, it must be borne in the heart, not the purse of industrial management; and it must permeate through and through the whole system of supervision.

The most efficient supervision must of necessity render the most humane service, and in every embryo this must take the form of human interest. In every form of sport, superior achievement and skill in performance are coveted and won by the greatest sacrifices of time and energy. Why not in industry? The answer is easy. Motive. Reward for skill. Praise for achievement. Merit well earned. Contest. Battles won with honor. The true sportsman is heroic. He is no slave. Can this spirit be put into industrial life? No. It cannot be put in. It can be born in.

James J. Hill of the Great Northern is a good example of how a man can lead his men in playing the game of big business. With only one exception he led his men without trouble in opening up the great Northwest. His ideal was service, not fortune building. Every man under him knew him as "Jim" Hill. They respected him for his superior grasp of railroading and for his personal interest in his men. The names of John Wanamaker and Henry Ford are splendid examples of how men breathe their own spirit into their organizations. If an executive is a man of vision, a man of broad sympathies and high ideals, a man of efficiency and energy of character, this entire force will be a wide awake body of live wires.

The spirit of efficiency must be back of all really efficient work. Better quality and greater quantity should be the aim, but not at the expense of life. Greater speed on the part of the workman will produce greater accuracy of workmanship. But the greater speed should be made possible by eliminating unnecessary motions, and by making necessary motions thoroughly automatic. The result will be a relief of drudging labor and the freedom of the man. Then he will be happy and work contentedly. Speed, skill, freedom, this is the order in the efficiency program.

A genius is a genius because he accomplishes more than others. In the last analysis genius is the power of achievement. But following the roadway backward from the result achieved to the home of genius, and then into his soul where his power plant of ideas and personal energy are stored, we find a most interesting problem. How does he do it? That is the query. That is the miracle. The miracle he performs is made possible to him because of his internal, subconscious energy. This energy is the product of an electric will which, working economically, has stored up power and systematized energy, often out of pure necessity, where it can be drawn upon at any time much as we draw upon a storage battery when in need of electric service. Many men are perfectly prodigal of their energies. The genius is not. All great men of the world have had their mental machinery well-equipped with energy, and the larger part of such machinery operating automatically. The genius operates both his mental and subconscious machinery to free his soul, making his body work for him under the most fascinating discipline. So we discover that the secret of achievement, or of efficiency rests on dynamic will power, together with a thoroughly trained subconsciousness. The more work we can do to-day, automatically, the more inspiring and creative work will become, the more of a man a man becomes, and the less of a machine. His subconsciousness acts with perfectly automatic precision. The mechanical element lies below the mental surface, so that really great achievement is the work of a free spirited man depending on his efficiently trained reflexive powers to carry out his desires. We call him inspired because he is both freer in spirit and more subconsciously mechanical than we are. Efficiency, therefore, must ever depend both on efficient desire, as well as upon the efficient organization of our reflex powers.

Every man should be more of a man, a better man, for having worked a day. The humdrum shop, operated by humdrum workmen, managed by humdrum superintendents, dominated by humdrum ideals, should be banished to Humdrum Land, if for no other reason than to save the men.

What is the man-making motive, and how is it generated, may I ask? In industrial life, who coins the man-making motive, and where is the mint? It must be acknowledged that the industries to be efficient must not be efficient at the sacrifice of men, but on the contrary, they must be efficient first of all in developing men, real men, men of heart and men of high character, before they have a right to be efficient either in business or in production. Doubt it do you? There are thousands of factories to-day running on an imaginary schedule of efficiency where men are robbed of the opportunity to develop themselves, where a business success is more of a hold-up game than a scientific, or economic process. I say a hold-up game because money can never be spent wisely and profitably where it demands the service of men, and at the same time imperils their character. Deterioration of men deteriorates profits. What shall we say then of the mental process of developing men, of growing manhood in the industries? How are men to know that they are growing to manhood while they work? If the larger opportunity is given to industrial employees, and they know that the conditions and inspirations of industrial life make for better manhood will they respond to it? Will the response to such industrial inspirations react for higher daily task efficiency? One only needs to step into such factories as the Franklin Automobile Works, or the National Cash Register Company's plant to get a decided, positive answer.

Loyalty! Loyalty is inspired of confidence, confidence in men who believe in men, and who believe in God. No man over men who can damn his men has their confidence. And no plant operated without a definite welfare program can hope by a mere wage motive to win the loyalty of its working force. Every sensible man must realize the justice of being able to work at a man's job, under the direction of a manly man, at a man's wage, with a manly confidence in the heads of his concern. Many an industrial concern to our knowledge is running the gauntlet to-day of a perilous turnover, hiring ten to fifteen thousand men to maintain a force of five thousand. And why? Confidence. Loyalty. There you have it in a nutshell. Concerns that have the power to inspire confidence know little about this vexing problem. Men, like plants, grow in a healthful atmosphere. And, given an inspiring industrial atmosphere where man-timber may be grown to its richest and best, the fruit of contentment must inevitably follow. Manliness with contentment is great gain. We can but hope that the day is not far distant when the greater industries of our country will be operated first of all for turning out full grown, high charactered, industrial workmen, and incidentally and necessarily, most efficiently their material product.

INDUSTRIALISM AND APPLIED PSYCHOLOGY

By Paul Kreuzpointner, Altoona, Pa.

The reader will be led by the title of this article to inquire: What is the relation between industrialism and psychology? And what do we understand by the term 'industrialism'? The practical application of steam and electricity, together with scientific discoveries and mechanical inventions, have made it possible to control the forces of nature in the interest of humanity and for the service of mankind; and just in proportion as these practical applications have been made, it has been possible to develop a country's resources, and to feed, house and clothe a greater number of people. The increase in population has in turn given rise to a necessity of mass production and mass transportation, in order that the ever-growing multitude of peoples may be kept alive, and in order that their activities may be regulated. Mass consumption has necessitated mass production; and mass production in turn has necessitated the concentration of large groups of men and women at suitable localities, subject to centralized authority and military discipline, in order that the group should be kept active along required lines for united efforts. But this mass production and mass action have wrought a change in our traditional conditions of life,—social, economic and ethical,—in a way which is directly ascribable to the development of our industries; and the social-economic results which have arisen from these extended and concentrated industrial activities are expressed by the term 'industrialism'.

In consequence of its effects upon the intellectual, ethical and physical life of the people, this industrialism is responsible for a thoroughgoing change in the mentality of all the people; this change, however, is greater in the case of the industrial and urban population than in the case of the agricultural and rural population. In the interest of applied psychology, it is well to recognize that there are two phases in the influence of industrialism upon the mentality of the people: There has been a change in the old established mental habits and processes which were the result of our pioneer life and of the agricultural state of our pioneer society; and new mental habits have resulted from the intensification of our modern industrial and economic conditions.

Any one who had the opportunity, forty or fifty years ago, to observe the mass action of young people who were already engaged or intended to engage in industrial pursuits, will testify to the fact that a transformation of mental habits and mental activities has really taken place. In 1873 the writer, at the age of 31 years, became a pupil of the State Normal School at Edinboro, Pa., during the widespread financial panic of that period; it was not his intention to become a teacher, but being thrown out of work by the panic he simply desired to improve his education. In 1874, when living at Erie, Pa., he induced the school board of that city to open a 'Free Industrial Evening School,' the pioneer school of this sort in Pennsylvania; and he had charge of that school for three years, until a new school board closed all the existing evening schools. Having kept in close touch with the American youth ever since, both in shop and in school, the writer has during the past ten years frequently expressed the opinion that the American boy of to-day is not so mentally alert nor so keenly observant as the American industrial boy of forty or fifty years ago. Why this change? Fifty years ago we were still close to the pioneer conditions of American life; and the mentality of the American youth of that period still reflected the mentality of those pioneer days, industrialism having not yet had time to make itself felt. Our youth of that period were consuming the inherited stock of self-reliance, of individual courage and quickness of perception in danger, of self-respect, and of independence of action; and that ubiquitous and unique product of early industrial life in America, the 'Jack-of-all-trades,' was still flourishing in our midst. Now, after two generations of mass production by means of machinery, of automatic appliances, of military regime, and of consequent repression of initiative, this formerly virile product of pioneer mentality has been reduced to the status of a mental and physical automaton, whose activity consists in feeding his machine or in computing long rows of figures by means of a machine, with a minimum of mental exertion. Modern industrialism, spurred on by an ever-growing economic pressure, intensifies the effect of these mentally deteriorating influences upon millions of individuals in shops, stores and offices,—a state of affairs which induces mental stagnation and produces human automatons.

What is to be the end of it all? Can civilization survive such a stagnation of mentality? Here is where applied psychology should find a fertile field for cultivation. Thus far the science of psychology, in so far as it has attempted to be practical, has devoted itself to the task of finding the round peg for the round hole; and this attempt at vocational guidance is essentially an attempt to select suitable material to perpetuate the process of feeding the industrial and commercial mind-killing machine. Is there not a danger that in time, vocational guidance will become a part of the industrial machine itself? The work of the vocational psychologist, however, is not to be criticized or discredited; it is necessary, and we mention it here only as an illustration of the way in which increasing economic pressure compels industrialism to levy tribute on all of the sciences in order that its efficiency may be maintained and increased.

Here, then, we come to the crux of the question as to what is the function of applied psychology. What can applied psychology do to prevent or at least to minimize the mental deterioration of those for whom it has found suitable niches in the industrial machine, in order to prevent the social organization from degenerating to a lower mental level than is necessary to maintain orderly government and a progressive civilization? What is to be done in order to avoid the undesirable state of affairs that scientific psychology should unwittingly contribute to this mental degeneration by turning its expert knowledge to the task of picking out suitable material to fit as cogs into this mentally atrophying industrial machine?

Applied psychology must consider three distinct but closely interwoven phases of modern life. These three phases, working silently and insidiously, though none the less effectively, are the results of the reactions of modern social-economic organization upon the social-ethical life of the peoples of industrial nations. These results have been observed in Germany and in other industrial countries, where, however, they are found to vary in effectiveness in accordance with conditions of life.

One phase which deserves the attention of applied psychology is the necessity of readjusting and adapting national habits, inherited from pioneer times, to modern economic and social requirements. Our national habits of wastefulness and carelessness are the result of our inheritance from a time when the wealth of our resources seemed to be inexhaustible, and where this apparent inexhaustibleness permitted a lavish use and even waste of our resources for experimentation in an effort to develop these resources with feverish haste. This waste was frequently inevitable and excusable in view of our dearth of technical knowledge, our lack of experience, and the absence of any economic necessity for conserving our resources; the waste was perhaps greatest in the use of lumber and in metallurgical operations. Newspapers and magazines meanwhile were constantly dinning into the ears of the growing generation the self-deception that our resources were inexhaustible. The suggestion that resources should be conserved was derided as a miserliness which is unworthy of an American; and when, in 1869, the writer began to advocate the view that our mental resources, lying latent in the mass of people, should be developed by means of industrial education, he was derided as a crank not only by ignorant people but by business men and university graduates. It is no wonder, then, that the present generation is afflicted with habits of carelessness and wastefulness, and that the path of least resistance and the short-cut are chosen in an effort to 'get there' as rapidly as possible. The discovering of the best means to readjust or to eradicate these habits should be one of the aims of applied psychology.

The second phase which deserves our earnest attention has to do with the circumstance that the specialization of labor and the monotony of repetitive operations, mechanical and clerical, has an atrophying influence upon the mental activity and initiative of millions of workers in shops, stores and offices. Certain psychologists have claimed that no such atrophying effect results from the monotony of work. It is true that even the veteran tender of the automatic machine makes a superficial showing of intellectual ability and sprightliness unless he be naturally dull and stupid. But if these psychologists had observed that individual in his daily routine of life and work year after year, they would have noticed that he lacks initiative and is helpless when obliged to change his accustomed routine, and they would have observed that he is deficient in reasoning power and judgment when dealing with questions of public interest or questions which concern the relation of his work and his employer's business to his own job and the security of earning his bread and butter. They would have noticed his growing inability to grasp the import of municipal, state and national questions. Why do our educational and other public institutions produce such meagre results in the management of political and social affairs? Why does the demagogue still flourish? Why do we still have the 'pork barrel' with us? And why do the 'something-for-nothing' schemers still succeed in drawing big crowds? Let us see. The writer had a friend, a very intelligent mechanic, who failed in business and in a fit of discouragement enlisted in the army. He has told me of the expedients to which the soldiers in the Western forts resort in order to counteract the monotony of army life. They go out on the prairie, become intoxicated, fall asleep in the sage-brush and run the risk of being charged with desertion,—not for the sake of drinking but for the purpose of reviving their drooping, stagnant minds for a few hours. A superintendent of schools once asked the writer for a frank opinion concerning the efficiency of his schools; and the writer as frankly replied that although his schools were as good as others, yet in them as in others the children in the intermediate grades were becoming duller instead of brighter. That is, there were mental forces at work in these schools which tended toward arrested mental development or atrophy of mind. And the superintendent admitted having noticed the same state of affairs. If this happens in the case of young and active minds,—and no one can deny that it does happen all over the country,—why should not the same atrophying forces exert an even stronger influence under the more disadvantageous conditions of 'set' and indifferent minds in shops, stores and offices?

When the writer was connected with the physical testing laboratory of the Pennsylvania Railroad, much of the preparing of the test pieces had to be done in the shops, sometimes as many as eight men being engaged in that work. Because of the nature of the work, good mechanics were assigned to it. Yet constant care was always necessary in order to insure the work being done properly, not because the men were not intelligent enough or skilled enough, but because it was difficult to get their minds out of the mental groove which had been cut by their unvarying daily routine. And it was difficult for them to obtain a mental picture of anything which lay outside of that routine. The writer has frequently had occasion to observe this groove-like working of the mind, even in men of literary and especially of purely technical education who are in consequence unable to grasp the larger, broader functions and relations of their occupations or of social life. Is there not a close relation between this desire and necessity to obtain a broader mental view, and the popularity of moving pictures which visualize life but require no mental effort on the part of the audience?

The third phase of the problem which must be solved by the assistance of applied psychology if it is to be solved at all, pertains to the struggle for supremacy between industrial autocracy and social democracy. The control of nature's laws by applied science and technique has created industrialism with its unavoidable concentration of corporate management and its unavoidable autocratic regime. The necessity of concentrating the management of the huge modern industrial and commercial organizations into the hands of a few, and of demanding of all within the organization that they shall submit to an almost military discipline would be the same under any form of political government, whether autocratic, aristocratic, oligarchic, democratic or socialistic. But the more the existing form of political government resembles the autocratic regime of industrial organization, the less likely is a conflict between the social forces and the industrial regime.

The autocratic political government and the autocratic industrial organization are alike in that they both exhibit feudalistic tendencies; and hence in an autocracy the masses of industrial workers are not affected by any essential differences between their social life and their political life. But in a democracy such as ours, there is constant liability of friction between the industrial organization and the social organization. The industrial organization rests upon a scientific basis, with experts as advisers and managers; democracy rejects expert knowledge and advice, claiming that popular intelligence is adequate for the management of the affairs of the commonwealth. But since corporate interests and public interests are co-existent and co-ordinate, they must have constant dealings with each other. Hence it frequently happens that corporate expert knowledge and popular government knowledge come into conflict; and the consequent reaction upon the public mind is unfavorable because the public has no faith in expert knowledge.

A more serious difference of opinion arises from the fact that the industrial organizations clamor for a more efficient education of the people, and from the fact that the inefficient democracy is reluctant to grant this demand, alleging that such an education is unnecessary and is beneficial only to the financial interests of the industrial organization. Then, too, the spirit of individualism and independence which is fostered and promoted by democracy is at variance with the autocratic regime and the military discipline of the industrial organization; this conflict produces a condition of life both inside and outside the works which is not contemplated with favor by the employees, however willing they may be to submit in order to earn a livelihood.

But worst of all, and productive of most ill-will and misunderstanding between corporate industry and the populace, is the frequent display of feudalistic tendencies on the part of the corporations,—in their endeavor to guide the social, the spiritual, the ethical and the educational life of the people of the community. The object of this endeavor is always philanthropic and praiseworthy in so far as it aims either to give to the employees and their dependents the benefits of organized guidance by experts, or to cultivate a sense of corporate loyalty by dispensing feudalistic benevolence. But in modern times, when contract is the only relation which is recognized between employer and employee, contract relation and feudal relation can not co-exist without generating friction and misunderstanding. Feudalism received its sanction and strength from the personal relation and the mutual responsibility between feudal lord and retainer,—the feudal lord furnishing protection and security of status, while the retainer gave service in return, these mutual ties of protection, benevolence and service existing for life and extending over the community as a proprietary right and duty. This, however, does not mean that corporate industrial organizations should not concern themselves with public welfare in their own interest and in the interest of their employees, nor that they should not lend their expert knowledge for that purpose. All the ethical, political, social, educational and economic group-interests in a community are so intimately interwoven that they can not be separated without injury to some or all of the groups. Hence all social forces in a community should co-operate to the extent of their ability for the purpose of fostering their mutual interests. But if any one group or interest should step out of that co-operative circle, and if it should, directly or indirectly, assume the control or direction of those educational, ethical or social forces which in a democracy are matters of public concern, such an action will inevitably create a feeling of resentment, and a conviction that however well-meant the endeavor, it constitutes an encroachment upon democratic freedom and personal liberty.

If an interest which thus acts in a spirit of benevolence possesses the power of employment, and if from an entirely benevolent motive it claims the right of thus guiding and guarding not only the industrial but also the social and ethical interests of the employees, then the action becomes feudalistic. It clashes with the established democratic institution, producing fear and mental and civic inactivity on the one hand, and on the other hand, creating an under-current of antagonism against such measures as are just, timely and really helpful. The situation is analogous to one where in fighting a forest fire one group of fire-fighters pushes the others back, being convinced that mentally the latter are not so well-equipped although physically quite as strong. Under such circumstances the rejected group would stand back sullenly and give only half-hearted or no assistance. But if the superior group were helping to educate the inferior group in the art of fire-fighting, and should do so in a spirit of co-operation, team-work and good-will would result instead of resentment.

Summing up the influences of the modern industrial organization upon the equally modern democratic social organization, we find that the former reacts unfavorably upon the latter in certain ways: The expert economic management is distasteful to inefficient democratic management; the unavoidable military factory regime and discipline exaggerates democratic freedom; the demand for ever-increasing efficiency makes undue demands upon our undeveloped and neglected mental resources; and the feudalistic tendencies which attempt to hitch democracy to the personal service of industrial autocracy are all at variance with our inherited spirit of excessive individualism and with the spirit of our political institutions. The result is misunderstanding, distrust, lack of harmony, hindrance to progress, abuse of talent, and waste of mental and material resources. The more exacting the restraint which is necessary within the shop gate, the greater is the desire to revel in democratic freedom outside the shop gate. The restraining rules within the shop gate can not be broken without risk of loss of bread and butter; the civic restraint outside the shop gate is largely of the employee's own making. And it is small wonder if these civic restraints are often treated with indifference and are even brushed aside in consequence of the mental reaction from the effects of the industrial restraint. May not the growing mob-spirit be a manifestation of that mental reaction? In monarchical countries this phenomenon is better understood, and provision is made for public amusements and entertainments of various sorts in order to divert this reaction into safe channels. But democracy does not yet seem to have learned how to attack this psychological problem.

It is obvious that legislative enactments are insufficient educational agencies to cope with this serious problem. What we need is a change in our national habits and customs, in our mental and moral characteristics. And here is the opportunity for applied psychology to step into the breach in order to harmonize the contrast and antagonism between the industrial regime and the democratic regime.

The National Association of Corporation Schools is doing pioneer work in furthering this object. The apprentice schools and the various special schools maintained by the members of that Association within their establishments at their own expense, are conducted not only for the purpose of satisfying the vocational needs of the concern but also for the purpose of endeavoring to correlate and co-ordinate the vocational subject with the cultural and social economic life of the students of the outside world. In other words, they are endeavoring to socialize the schools in a way which is useful in that it prepares the student for the civic duties of his democratic environment without being feudal and benevolent. Upon this broader social-economic basis they can co-operate with the public school system for mutual benefit, the shop and commercial schools reacting encouragingly upon the public schools, while the latter furnish better preparation in return. And with the introduction of corporation or employers' continuation schools, this sphere of educational and social usefulness of corporation schools will be widened because not only do continuation schools reach larger numbers than the purely special schools, but since the training in the continuation schools is not specific but tends rather to develop general intelligence, these schools serve, at least in part, to bridge the gulf between the exacting demands of industrialism and the public demands of democracy.

HUGO MÜNSTERBERG: IN MEMORIAM

By William Stern

(Translation from the *Zeitschrift für Pädagogische Psychologie und Experimentelle Pädagogik,* Jan., Feb., 1917)

The science of psychology has again suffered a grievous loss. On Dec. 17, 1916, in his fifty-third year, Hugo Münsterberg was overtaken by death while lecturing. Thus even to his last breath he was unceasingly active, as unceasing work was a dominant quality of his character. Not the quiet work of the scientist's cell, but a far reaching public activity, the organization of the realms of politics and *Kultur,* the transference of scientific knowledge and methods to the demands of practical life—these, especially in recent years, had become the chief occupation of his life. But at the same time he was an investigator of penetrating sharpness, with a power of presentation marked by genius, and he was also a philosopher who had struggled most earnestly with the great problem of the theory of the universe (*Weltanschauung*). That he did not nevertheless always reach a full unification and harmony of its manifold features, that often enough indeed two souls fought within him, forms the tragedy of this personality.

This appears even in the fact that he was a man with two Fatherlands. He lived in Germany, where he was born in Danzig on June 1, 1863, through his apprenticeship years and also began there his mastership years. He studied in Leipsic, chiefly with Wundt, and in Heidelberg with Windelband; he obtained the doctorate in philosophy and in medicine; he was docent and professor extraordinary at Freiburg. In 1892 he took the authorized leave of absence for a few years in order to establish a psychological laboratory at Harvard University (Boston), the chief institution of higher learning in America, and there he remained till the end of his life, almost a quarter of a century. He was often in Germany, but always as a vacation traveler, or as in 1910-1911, as exchange professor at the University of Berlin. A permanent opening for work in the Fatherland, such as he himself silently longed for, did not come.

For many years Münsterberg considered it his special problem to strengthen the relations between his first and his second homelands. His books on America and the Americans, the founding of the American Institute in Berlin, his proposal to shape the Hamburg institution of higher learning as an embodiment of American University ideals, his share in the psychical organizing of German-Americans, as well as many other things, testify to this. He did not always find sympathy in these attempts either here or there. But at the beginning of the world war, his attitude became completely unambiguous and unconditional. He realized that he was a German, and regardless of consequences he began at once a spiritual war against the traditional English sentiment at Harvard. What this meant to him is shown in the following portion of a letter sent to me in February, 1916: "Day and night I work both before and behind the scenes, almost entirely in the interests of the political struggle, and fortunately thus I can accomplish much. Of course almost all of my old relations are severed, especially here in Boston. Most of my friends here no longer recognize me; I have been thrown out of clubs and put out of academies. All their rage has concentrated upon me. But we hold out." The hope which he expressed in the same letter, "I hope I can soon see your institute, for it is our plan to take the first Hamburg steamer that crosses," will now never be fulfilled.

Scientifically also there were two souls in Münsterberg, which never were completely harmonized. As a psychologist, especially in the first period of his investigating, he was most sharply oriented for natural science. Psychology has to do with the contents of consciousness as *objects of factual consideration, with their analysis into simple elements* bound together by causal laws, and with their resolution into the accompanying physiological phenomena. When man is "psychologically" explained he ceases to be a personality. There are then no inner purposes and attitudes, no significant totality or vital value, but only psychical elements, which are related to one another and to the physical according to regular laws. But on the other hand, Münsterberg is very far from denying the correctness of that other point of view; he even thinks it the truer and higher, only lying outside of all psychology. Philosophically he professed himself an idealist, in which his inner relation to the Baden group, Windelband, Ricker, J. Cohn, appears, but with an especial inclination to Fichte. His *Weltanschauung* was constructed upon a theory of value which is completely independent of the causal considerations of natural science. In it there is no longer question of cause and effect but only of end and norm. Here man is not the object of analytical knowledge but the subject of a unified attitude. Here life is not a mechanical natural process but a significant relating of purposes.

Thus the outcome is a two-world theory which leaves unsatisfied the yearning of man for a final unity, and yet only where unity is, is there a true *Weltanschauung*. To me Münsterberg seems here to be the typical representative of a period of transition. The insight had awakened that a psychology which is only an analysis of consciousness does not do justice to the value of personality, but the determination was still lacking to reform psychology from the ground up so that it could also do justice to the theory of personality. What must come is a personalistic psychology.[1]

The sharp separation of the psychological investigation of facts and the ethical theory of ends also found in Münsterberg a formulation important pedagogically, which one must agree with in its fundamental ideas in spite of other differences of opinion. Münsterberg fought with zeal a false "psychologism" in the teacher. Wherever a man has actual dealings with other men, and so especially in teaching, he must evaluate unitary subjects, he must strengthen personalities in process of development, but not explain the contents of their consciousness. He who forgets this runs the danger of neglecting the ethical problem. The teacher who has to do only with psychology in all his educating, easily considers his pupils as mere samples of interesting psychical phenomena; he also feels himself easily lured off to deducing the purpose of education from the psychological conditions, while these furnish only the means by which ends sanctioned on far other grounds can be attained. This warning of Münsterberg against overmuch preoccupation with psychology aroused in its time much surprise and contradiction among teachers. One can only completely evaluate it from the background of the American situation. In fact, there seems to have been for some time a very one sided cult with psychological experiments as the chief object of the teacher's training; perhaps a protest against it was not entirely unjustified.

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[1] Perhaps I may mention here that just this sharp formulation of the split in Münsterberg was the determining factor for me to transfer the views of personalism to psychology also.

But naturally Münsterberg's positive work in the field of psychology is far more important. In the first period of his theoretical investigation we must mention especially the theory of the will (in which he reduces the will to an aggregate of sensations and muscular tensions) as well as the *Aktionstheorie* connected with it, which also ramifies into the realm of pedagogical-psychological interests. According to this the elementary, primitive form of the psychical life is not the sensation or idea, that is, a passive given, but the immediate unity of impression and expression, of sensation and muscular movement. The entire modern basal principle of self activity, the work principle, etc., is related to this idea expressed by Münsterberg more than two decades ago. That originally he tended to overvalue the purely muscular factor we must refer to the newness of the thought.

But more and more his interest in psychological theory was replaced by one in applied psychology, and here his universalistic spirit, participating in the manifold ramifications of *Kultur,* stands revealed. During the years when we in Germany had only cautiously and tentatively begun to shape methods for the new problems of application, Münsterberg had penetrated into the fullness of human life, had laid down a general program, and in four books of his own had given a wide outlook into the possibility of making psychology effective in the administration of justice, the healing of the sick, education and industrial life. It is true that often he showed more boldness and power to image future possibilities than he did cautious technical knowledge, but much greater than this is the service which he did of attracting publicity (even non-psychological) to this perfectly new method of controlling *Kultur,* and of drawing the great guiding lines for future work. Most of all is his work path-breaking on the Psychology of Industrial Life. In this he describes the American Taylor system of scientific management, on its psychological side, and presents his now notable experiments on the vocational selection of street-car conductors and telephone operators. Here he gave the impetus to the attempts which are now also introduced into Germany, to make vocational choices from a psychological point of view.

In his last great work, Psychotechnik, Münsterberg gives a unified presentation of the various possibilities of applied psychology. Perhaps the educator will not find overmuch that is new in the section on education, for the study of children was somewhat aside from Münsterberg's interests. Of far more service will be the section on industrial life, especially the general part, which gives an attractive presentation of the significance of psychotechnics in general and of its two chief ends, psychological prediction and psychological control.

In Münsterberg psychology loses one of its most important leaders and most stimulating thinkers, whose thoughts will fructify both theory and practice long after his premature death.

Münsterberg's chief scientific German works are the following (all published by J. A. Barth, Leipzig): Beiträge zur Exper. Psychologie, 1889; Grundzüge der Psychologie, I, 1900; Philosophie der Werte, 1908; Psychologie und Wirtschaftsleben, 1912; Grundzüge der Psychotechnik, 1914. In addition he published a number of works in English. The works from his laboratory appear in the Harvard Psychological Studies.

BOOK REVIEWS AND NOTICES

ROBERT M. YERKES, JAMES W. BRIDGES and ROSE S. HARDWICK. *A Point Scale for Measuring Mental Ability.* Baltimore: Warwick and York, Inc., 1915. Pp. viii+168.

In the fall of 1913, Yerkes proposed to Bridges that they should coöperate in an attempt to construct a measuring scale for intellectual ability which should consist of a single series of tests, in connection with which credit should be given according to a graduated scale of one hundred subdivisions. The present volume offers the results of this endeavor.

In Part I Hardwick gives a general description and the relations of the Point Scale. The twenty tests, arranged for the sake of convenience approximately in the order of their difficulty, are designed to cover various forms of the principal mental functions, such as perception, discrimination, motor coördination, association, memory, imagination, etc. The point method of scoring according to the merit of the subject's response has many advantages over the 'all-or-none' principle. It brings out the full value of the testing material, and thus gives a far more complete and detailed account of the individual from the psychological point of view without increasing the expenditure of time and energy. One hundred is the maximum score. Hence if an individual obtains a total of 70 points, and the norm for a group of his own age, sex, race and social condition is 80, the degree of his retardation is expressed in graduated terms. Following a detailed description of the method of using the scale, Hardwick discusses the relation of the Point Scale to the Binet Simon Scale. There are two chief points of departure between the two scales: Firstly, the age arrangement of the Binet Scale assumes that the mental development of all normal individuals proceeds by similar stages, that the correlation between different functions is the same for all individuals at a given stage, and that each stage of mental development corresponds, in turn, to a certain physical age. The originators of the Point Scale question the validity of this assumption. Secondly, by the Binet method of scoring, the subject either fails or succeeds. Degrees of failure or success are not taken into consideration. This is eminently unfair to the examinee.

In Part II Yerkes and Bridges present the results of the application of the Point Scale to 805 individuals: 675 pupils of a city grammar school located in a medium to poor region and including grades from the kindergarten to the eighth, inclusive; 54 kindergarten and first grade pupils of a grammar school located in a good neighborhood; and 76 adults ranging in age from seventeen to forty-three years. In analyzing the results of these examinations, many factors which have a bearing on the individual's score become apparent. Norms for age, sex, linguistic and social status are calculated on the basis of the statistics at hand. The tremendous importance of obtaining as much information as possible concerning the life history of the individual to be tested is repeatedly emphasized by the authors. By taking 675 of the pupils and the 76 adults, irrespective of language or sex differences, the age norms of the following table are obtained:

Age	4	5	6	7	8	9	10	11	12	13	14	15	Adult
Number Tested.	5	39	71	73	61	74	76	79	60	60	52	25	76
Score	14	22	29	34	39	52	59	64	74	74	78	77	91

It must be borne in mind that these norms, obtained as they are from an insufficient number of records, can not be accepted as final. For the present, however, they may be considered as fairly representative and are at least highly suggestive.

In Part III Hardwick gives a brief report on 155 hospital cases examined by the Point Scale. In Part IV Yerkes describes the Point Scale revised on the basis of the results already obtained with the original scale.

Descriptive Title of Test	Maximum credit
Aesthetic comparison and judgment	3
Perception and comparison of pictures (missing parts)	4
Comparison of lines and weights	3
Memory span for digits	5
Counting backward	4
Repetition of sentences	6
Description of three Binet pictures	9
Arranging cubes according to their weight	2
Comparison of the three pairs of objects	6
Definitions of concrete terms	8
Resistance of visual suggestion	3
Copying of simple geometrical figures	4
Free association	4
The use of three given words in one sentence	4
Comprehension of questions	8
Drawing designs from memory	4
Criticisms of absurd statements	5
Construction of sentences	6
Definitions of abstract terms	6
Analogies	6
Total	100

Having obtained the Point Scale score for a given individual, there are various ways of expressing the relation of the score actually achieved to the expected score or norm. There are four expressions which Yerkes considers useful in reporting the result of an examination. These are: (1) The Point Scale score; (2) the mental age; (3) the mental status; and (4) the coefficient of intellectual ability (Point Scale score divided by norm). For example, if a six-year-old English-speaking boy obtains a score of 25, his coefficient of intellectual ability is 25 divided by 29 (norm of the English-speaking group of males six years old) or .86. Twenty-five points is the average for a boy 5.5 years of age. Hence this individual is .5 year below age. His values, then, are: Score, 25 points; mental age, 5.5 years; mental status, —.5 years; coefficient of intellectual ability, .86.

Yerkes is convinced that the Point Scale, in spite of a number of serious defects, is much superior to the Binet-Simon Scale. Yerkes proposes to develop what may be called a Universal Point Scale, in which the principles of a single series of measurements, graded with respect to difficulty, and of credit according to merit, shall be so used that individuals ranging in age from three years through maturity may be measured with equal satisfaction, and their mental status expressed not partially as, for example, in terms of intellectual ability, but, more completely, by means of an equation which shall include affectivity as well as the other principal mental functions.

Clark University. CARROLL C. PRATT.

LEWIS M. TERMAN, *The Measurement of Intelligence.* Boston: Houghton Mifflin Co., 1916. Pp. viii+362.

Before any satisfactory reform of the many evils prevalent in our educational system can be expected, the existence and significance of the many differences in mental endowment of school children must be taken into account. The school must adapt itself to the requirements demanded by the many grades of intelligence, ranging from idiocy on the one hand to genius on the other, which are brought to light by scientific diagnosis and classification. In the future, intelligence tests are certain to play an ever-increasing rôle as a basis for grading, for vocational guidance, and for diagnosing feeble-minded, delinquent and superior children. Many fallacies current among teachers, such as the over-estimating and the under-estimating of the intelligence of retarded and superior children, have been pointed out by Binet, who keenly felt the crying need of standardization. The particular merits of the Binet-Simon method of testing intelligence are: (1) *The use of age standards*; (2) *the setting of problems* which demand reason, ingenuity, judgments about abstract matters, etc., instead of attempting to measure sensory discrimination, mere retentiveness, rapidity of reaction and the like; and (3) the attempt to test 'general intelligence' rather than memory, attention, imagination, etc., which belong to 'structural' and not to dynamic psychology. Binet's conception of intelligence emphasizes three characteristics of the thought process: (1) Thinking tends to take and maintain a definite direction; (2) it is capable of making adaptations for the purpose of attaining a desired end; and (3) it possesses the power of autocriticism. The guiding principle with Binet was to find an arrangement of tests which would cause an average child of any given age to test 'at age,'—that is, the average five-year-old must show a mental age of five years.

It has been found that in many cases the average child does not test 'at age' on the Binet-Simon scale; and it was to remedy this defect and to create greater uniformity that Terman's Stanford revision and extension of the scale was made. The revision involved the examination of approximately 2,300 subjects, including 1,700 normal children, 200 defective and superior children, and more than 400 adults; it also involved the adopting of a method of scoring which would cause the normal mental age to coincide with the chronological age. That is, the scale should give an intelligence quotient (I Q) of unity, or one hundred per cent for unselected children of each age. Ninety tests were chosen for the final revision, or 36 more than the number included in the Binet 1911 scale. There are 6 tests at each age level from 3 to 10, 8 at 12, 6 at 14, 6 at 'average adult,' 6 at 'superior adult,' and 16 alternative tests. Terman offers the following suggestions for the classification of intelligence quotients:

I Q	Classification
Above 140	'Near' genius or genius
120-140	Very superior intelligence
110-120	Superior intelligence
90-110	Normal or average intelligence
80-90	Dullness, rarely classifiable as feeble-mindedness
70-80	Border-line deficiency, sometimes classifiable as dullness, often as feeble-mindedness
Below 70	Definite feeble-mindedness, morons (high, middle and low) and imbeciles

In discussing the cases analyzed, the author gives many facts of searching sociological and pedagogical import.

In Part II, Chapters VIII to XX, Terman gives a guide for the use of the Stanford revision and extension; formulates instructions for procedure in administering and scoring the tests at each age level; and suggests valuable hints for putting the youthful examinee at ease and arousing the desired interest in the task.

The author is of the opinion that conscientious practice will enable any intelligent and tactful person without psychological training to use the scale successfully. The clear and untechnical manner in which the book is written will make it of practical service not only to psychologists, but to teachers, physicians and social workers.

Clark University. CARROLL C. PRATT.

SAMUEL E. SPARLING. *Introduction to Business Organization.* New York, The Macmillan Co., 1916. Pp. xvi, 374.

The scope of this volume does not include business management, but attempts to bring together for the first time the various facts and principles upon which business is organized. "The first division is introductory, and is devoted to the classification of business activities, and especially to the legal aspects of business organization. The second division is devoted to a discussion of the principles of organization, the simplest forms of which are illustrated by a chapter on farming, followed by three chapters on the organization of manufacturing, and by several chapters on the organization of distribution. Among the subjects treated here are exchanges, direct selling, wholesaling and retailing, traveling salesmanship, the mail-order business, credits, collections, and advertising. . . . The purely social and economic phases have been passed over, except in so far as they threw light upon the problems of organization." The psychological aspects of the subject have received only a very modest general recognition in so far as they are barely hinted at in calling attention to the difficulties of selecting the administrative and labor forces and to the problems of appeal through improved advertising. But even here the author says that "while a great deal has been done to systematize the data and facts in regard to advertising, it cannot, however, be termed a science. All that can be said is that it is better understood to-day than it was a few years ago." The book contains no references to the literature, is written in a simple style, and seems to be well suited for young men entering upon a business career or upon a study of its underlying principles.

Educational measurements. By DANIEL STARCH. New York, Macmillan Co., 1916. 202 p.

After discussing marks as a measure of school work, and giving a sample survey of the marking system of a high school, the author gives a chapter each upon measuring ability in reading, writing, spelling, grammar, arithmetic, composition, drawing, Latin, German, French, physics, with a final chapter on the use of standard tests in school experiments, and a bibliography at the end. This is the best, as the latest ought to be, of its kind.

The following books and pamphlets have been received:[1]

WILLIAM A. WHITE. *Mechanisms of character formation. An introduction to Psychoanalysis.* The Macmillan Co., New York, 1916.

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[1] Mention here does not preclude further comment.

HARRY D. KITSON. *How to use your mind.* J. B. Lippincott, Philadelphia, 1916.

NORBERT J. MELVILLE. *Standard method of testing juvenile mentality. With an introduction by William Healy.* J. B. Lippincott Co., Philadelphia, 1917.

WILLIAM HENRY PYLE. *A manual for the mental and physical examination of school children.* University of Missouri Bulletin, vol. 17, No. 24, Extension series 21. Columbia, Mo. September 1916.

FREDERICK S. BREED and F. W. FROSTIC. *A scale for measuring the general merit of English composition in the sixth grade.* Reprinted from *The Elementary School Journal,* vol. 17, No. 5, January 1917.

—— ——. *Note on the relation of legibility and form in handwriting.* Reprinted from *School and Society,* vol. 4, No. 101, Dec. 2, 1916.

WALTER B. SWIFT. *The developmental psychology of stuttering.* Reprinted from *The Journal of Abnormal Psychology,* Oct.-Nov., 1916.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION, Bull. 25. *What is the Smith-Hughes bill providing federal grants to vocational education?* and *What must a State do to take advantage of the federal vocational education law?* Issued March 1917. 140 West 42d street, New York City.

—— ——. Bull. 19. *The selection and training of teachers for State-aided industrial schools.* (Revised edition.) Issued Feb. 1917.

ALFRED ADLER. *Study of organ inferiority and its psychical compensation.* Authorized translation by Smith Ely Jelliffe. Nervous and Mental Disease Monograph Series No. 24. New York, 1917.

Mental Hygiene, Vol. 1, No. 1, January 1917. Publ. quarterly by The National Committee for Mental Hygiene, Inc., Concord, N. H.

Journal of Delinquency, Vol. II, No. —, March 1917. Published bimonthly by Whittier State School, Department of Research, Whittier, Calif.

Kentucky High School Quarterly. April 1917.

APPLIED PSYCHOLOGY AT THE CARNEGIE INSTITUTE OF TECHNOLOGY. *Abstract from the Second Annual Report of the Division of Applied Psychology, including the Department for the Training of Teachers and the Bureau of Mental Tests.* Reprinted from the Fourteenth Annual Report of the Director of the Carnegie Institute of Technology for the year ending March 31, 1917.

SUMMARIES

LORLE IDA STECHER. *The effect of humidity on nervousness and on general efficiency. Arch. of Psych.*, No. 38, Dec. 1916.

This monograph is a part of an extensive study of the influence of air conditions on human beings conducted by the New York State Commission on Ventilation and reviewed by us in the previous issue of this Journal, pp. 94f. The present author, in chapter I, begins with a "History of Investigations of the Effect of Indoor and Outdoor Atmospheric Conditions," reviews briefly the three main classes of theories held during the nineteenth century, viz., the oxygen and the carbon dioxide theories, the organic poison theory, and the heat and humidity theory, she then gives a survey of the ventilation experiments carried on during the last thirty years in various countries, and finally summarises recent empirical studies by Dexter and by Ellsworth Huntington of the effect of climate on human welfare and efficiency. In the second chapter her own methods and experiments are described, which were planned and carried on, like those previously reviewed, under Thorndike's direction.

The degrees of humidity investigated in the present series were 50, 45, 37, 33, 32, 22, 21, and 20%, while the temperature remained constant at 75°F. Eight squads of four girls each, 17-18 years of age, recently graduated from the commercial department of a New York city high-school, acted as subjects. All conditions were kept as nearly constant as possible and various precautions were taken to control variable factors; for example, all subjects were paid for their services and received a dietetic midday luncheon of 1,000 calories per person per meal. The actual tests used were "(1) The purely physiological observations of pulse, temperature, and eye tremor, (2) The tests of efficiency in mental performances, such as addition and mental multiplication, (3) The tests of motor control and co-ordination," namely the three-hole aiming test, the hand-steadiness test for one minute, tapping for one minute, typewriting for ten minutes, an arm-steadiness test for two minutes, a simplified mirror tracing of a ten-pointed star, and an industrial fatigue test of five minutes duration. In addition to these tests, each subject had to indicate at the end of the three-hour morning session her degree of comfort according to an arbitrarily determined scale of five points, and her estimate of the temperature and of the moisture in the experimental room according to two similar scales.

The results as to the effect of humidity were just as negative as those previously reviewed. "The practical situation is that experimental humidity conditions considerably more rigorous than those obtaining in any artificially heated apartment show no demonstrable effect in behavior. . . . It must be remembered that in isolating the factor of humidity, we did not attempt to reproduce the conditions that go to make up a crowded, ill-smelling and excessively hot room. The very fact that the method of ventilating the experimental chamber produced a normal amount of air movement tended to alleviate the discomfort that would ordinarily be felt in a closed room under a 75°, 20% condition. . . . Whether this (general negative effect) is due to a real absence of harmful effects, or to the marvelous power of the human organism to adapt itself to a changed environment, is at present still a matter of speculation." The author has also computed many correlations among the tests and found surprising differences from the results of previous computers. One chapter gives a discussion of the effects of practice and of the variations in efficiency during the working day which in the main confirm those of previous investigators. An appendix contains the complete instructions to the subjects and samples of the test-material used. L. R. G.

EDWARD WEBB. *Character and intelligence. Brit. Jour. of Psychol., Mono. Supplements,* Vol. I, 1915, ix+99.

The frequency and importance of judging character is tremendous in practical life. Nevertheless, character has been described as "a perfect jungle of psychological expressions of unknown (or little known) meaning." In literature only the man of unusual character has been treated. Most of the individuals in this world, however, are more or less 'average' and 'colorless.' Webb hopes to study these phenomena of an average group of individuals by means of statistical methods. He defines the terms which he is going to employ in the following way. "Intelligence may be taken as including those qualities which are specially related to abilities in mental performances, while under character it is usual to include the emotional and volitional—the social and moral qualities." "Character is thus, for our purpose, the sum of all personal qualities which are not distinctly intellectual." (p. 2.)

The subject of personal character has been frequently handled in the literature from two widely different points of view. 1. Abstract propositions have been put forward such as the classification of 'temperaments'; 2. concrete judgments have been made acted upon by practical business men. Both viewpoints are marked by dogma and theory far in excess of the evidence put forward in their support. Although these analyses are not scientific in their treatment, we do find a few scientific studies which have preceded the present experiment. For example, Heymans and Wiersma attempted to establish a classification of types of character by the 'biographic' method,—by an analysis of the written lives of 110 of the leading men in the arts and sciences. They also employed the questionnaire method. Pearson tried to correlate estimates of general intelligence with estimates of a few mental qualities such as temper, popularity, shyness and the like. Ach and Barrett have approached a classification of temperaments from their experimental investigations of the will process. Stern advocates the use of the "psychogram,"—a complete, scientific mental analysis of an individual who has achieved success in one of the fields of human endeavor. But the actual results obtained by these investigators have contributed but very little to our understanding and analysis of this immensely interesting scientific and practical problem.

The subjects employed in the present investigation included two groups of male students, 98 and 96 in number respectively, in their second year of a training college in England; and also four groups of school-boys (average age of 12 years) in four different schools in London, numbering respectively 33, 35, 35 and 37. The judges who were to make estimates of these subjects, were 10 fellow students who had been elected Prefects for the year. These were chosen because they were able to study the subjects under all conditions,—in the class rooms, at social gatherings, at home and on the playing field. These judges were told to prepare themselves during the term by collecting evidence in order to write a general character sketch of each of their group during the Easter holiday. They were told to keep the strictest secrecy both with regard to the subjects and the other judges, and they were also told to make their observations as wide as possible, noting *any* ability, habit or tendency for each subject. In the case of the school-boys, the teachers acted as judges.

A list of 39 qualities were adopted for investigation. These were divided into five general groups. 1. Emotions (such as tendency to be cheerful, liability to extreme depression, readiness to become angry and recover from anger, etc.). 2. Self Qualities (such as desire to excel, eagerness for admiration, superciliousness, belief in own powers, etc.). 3. Sociality (such as fondness for large or small social groups, impulsive kindness, trustworthiness, interest in religious beliefs, wideness of influence, tact, etc.). 4. Activity (such as extent of mental work bestowed on studies and pleasures, degree of bodily activity during business hours and games, tendency *not* to abandon tasks in the face of obstacles, etc.). 5. Intellect (such as profoundness and quickness of apprehension, soundness of common sense and originality of ideas). A somewhat shortened list was used for the groups of school-boys. Also certain tests of intelligence were given,—namely, paired words of opposite meaning, and the reconstruction of disarranged sentences. For the second group of students other tests of intelligence were added, which included tests of reasoning, comparison, problematic situations, definitions and paired opposites. The marking of the various qualities investigated was made numerically by the judges by giving grades from +3 to —3. In this scale zero indicated the average ability, +3 a very high degree of the quality, and —3 the very lowest degree.

The results obtained are given very extended treatment largely by means of Spearman's corrected formula for the coefficient of correlation. The reliability of the estimates and of the results are tested throughout. The reader is impressed with the great industry shown in the present study. An astoundingly great number of correlation coefficients have been calculated at what must have been a very great expenditure of time and energy.

Following the teachings of Spearman, Webb examines the results for evidence of a general factor of intellective energy. He finds what he believes to be definite and conclusive evidence that such a factor exists by correlating the different intellectual tests employed each with every other one. He then finds that all of the intelligence qualities as estimated by the judges "show good correlation" with this intellectual factor. This general factor has a low correlation with the groups of self qualities and sociality; while in the group of activities some of the qualities have a low, some a high and some a negative correlation. Many such correlations are made which we do not have the space here to consider in detail. But another example may be of value. The results show that Quick Apprehension is highly correlated with 1. a marked emotional temperament, 2. strong egoism, 3. the lighter social qualities, and 4. bodily activity and pursuit of pleasure. The estimates under Profound Apprehension are correlated with 1. a calm temperament, 2. much less egoism, 3. the deeper social qualities, and 4. mental activity and purposive performance of duty.

In a subsequent chapter, Webb puts forth the hypothesis that there is a general factor of character which corresponds for its own qualities in the same way that Spearman's general intellectual factor corresponds to the particular intellectual qualities. A statistical treatment of the data leads the author to find that there is such a general character factor present which shows itself in varying degrees for the different particular qualities. As the author puts it (p. 58) "That a second factor, of wide generality, exists; and that this factor is prominent on the 'character' side of mental activity (as distinguished from the purely intellective side)." The author conceives "persistence of motives" "to be this general factor and that the particular moral and social virtues are derived from the more generalized quality." Some nine experimental studies from that of Müller and Pilzecker in 1900 to the work of Rath in 1914 are examined and analysed in the light of this hypothesis. Webb finds that his view is entirely in accord with that of Ach and at least not at variance with the other studies considered.

In a later chapter Webb considers the errors which are involved in making estimates of character qualities. These are of several sorts, inasmuch as, besides the random errors, there are several kinds of systematic errors. These latter may be due to a common bias in the mind of all observers or to the different observers taking different points of view. The author also includes two appendices in the text,—the first containing a synopsis of the mathematical formulae employed; and the second containing a selection of the reports of the judges as to what they understood by the terms used and what guided them in marking the subjects. A rather complete bibliography is appended.

From a consideration of these results Webb draws the following conclusions. He finds complete confirmation in his results of the hypothesis that there exists a general factor on the side of character which completely parallels the general factor of intelligence as advanced by Spearman and Hart. Estimates of the general factor of character are apt to be more pure measures than those of general intelligence. This general character factor "markedly dominates all the correlations yielded by the estimates of moral qualities, the deeper social virtues, perseverance and persistence; also, in the negative side, qualities related to instability of the emotions and the lighter side of sociality." The nature of this general factor of character "is best conceived—to be in some close relation to 'persistence of motives,' *i. e.* to depend upon the consistency of action resulting from deliberate volition, *i. e.* from will."

These are exceedingly interesting results and conclusions reported by Webb. There are several fundamental objections, however, which would appear to entirely invalidate this investigation. In the first place, Thomson[1] has shown in a recent paper that Spearman's method of calculation of data which led to his conclusion of the existence of a general intellective factor,—a 'general ability' as against special abilities,—is open to the gravest criticism. Thomson attacks the concept on purely mathematical grounds but his reasoning would appear to be unquestionably accurate. If this be the case, Webb's calculations are open to precisely similar criticisms and his conclusions must fall with the general concept.

But even if the concept be true, we do not believe that Webb's results justify his conclusions. His correlation coefficients are usually much too small to be taken as more than indications of tendencies. Certainly one would hesitate to make them the basis of sweeping statements such as Webb has made. A single example will suffice. On page 40, the author states that "All the intelligence qualities show good correlation" with the general factor. The actual coefficients in these cases are: quickness of apprehension 0.53; profoundness of apprehension 0.56; common-sense 0.29; and originality of ideas 0.47. Hence *no single coefficient in this group is as great as 0.60 and one is below* 0.30. The theoretical work with the correlation coefficient has shown that no value should be given significance, except as perhaps indication of a general tendency, if it falls below 0.75. Indeed the whole concept of the correlation coefficient has recently fallen into more or less disrepute. It has been recognized that there are only a few sorts of data which may be properly treated by these means. The use of the coefficient of regression is to be recommended in its place.

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[1] Godfrey H. Thomson. A Hierarchy without a General Factor. *Brit. Jour. of Psychol.*. VIII. 1916. 271-281.

Finally we would consider that Webb's method of obtaining his original data is open to suspicion if not to question. We think it doubtful if a group of young men and boys are capable of giving proper estimates of their fellow students with regard to the various qualities of intellect and of character such as were required of them. Webb speaks enthusiastically of the co-operation of these judges but we are not willing to accept the ability of such a group to make an accurate, unbiased and successful estimate of the various qualities which were required under the instructions.

Clark University. SAMUEL W. FERNBERGER.

J. E. A. WALLIN, Director of Psycho-Educational Clinic, St. Louis. Annual Report, as part of the Sixty-Second Annual Report of Education of the City of St. Louis, Missouri, for the year ending June 30, 1916, pp. 144-211.

The first part of this report, pp. 144-174, gives general data on census retardates which contain several important items of a wider than local significance. Among the ca. 90,000 pupils in the public schools there were 1,861 or 2.5% retardations, which is less than in other cities of similar size. As to the prevalence of feeble-minded children in the schools. Dr. Wallin agrees with Dr. W. S. Cornell of Philadelphia and Dr. D. P. MacMillan of Chicago that their frequence is .5%. He recommends among others special "speech corrective work" on a large scale with specially trained teachers to handle these cases, special classes for children who, while not blind, have seriously impaired vision which cannot be corrected by glasses, and similar classes for defects in hearing; but blind and deaf children should not be admitted to such classes.

The second part of the report is a study of speech defectives, which constituted about 2.8% of the total enrollment. This figure slightly exceeds the range of other large cities in this country. The boys show a prevalence of 3.6% against only .2% of the girls, and this difference is especially marked in the stutterers. Dr. Wallin says that his "results do not justify the widespread fear that training left-handed children to write with the right hand will cause the development of speech-defects." He also finds that speech-defects "were almost twice as prevalent among the colored as among the white children," but that the sex differences among the former are not quite so strong. A most significant fact is the high percentage of speech defectives among the mentally defective children, which was at least ten times as high in the special schools for retardates as in the white elementary schools. "In general, the lower the grade of intelligence of the group the greater the prevalence of speech defects. . . . Indistinct articulation is distinctly more prevalent among the mental defectives, while stuttering is more prevalent among the normal, retarded, and backward children than among the defectives." It is also interesting to notice that over 80% of the stutterres and 96% of the lispers manifested their defects before the age of six. There are relatively more stutterers among the colored than among the white children in every grade except the kindergarten and the fourth high school year." Speech defects have a definite relation to school retardation, since children with such troubles often are very sensitive and rather do not answer than expose themselves to ridicule and impatience. Such retardation is more marked with the stutterers than with the lispers and with the boys more than with the girls. Dr. Wallin concludes that "the correction of stuttering, lisping and some of the other remediable speech defects is just as truly a legitimate function of the public schools as the correction of faulty posture by means of physical training the mitigation of mental deficiency by means of individualized and differentiated instruction, the combating of phthisis through a special regimen in an open air school, or indeed the combating of illiteracy by providing instruction in reading, writing, and ciphering" and it is well recognized as such in Europe and in some of the larger cities in the United States. L. R. G.

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PROFESSOR MÜNSTERBERG'S VOCATIONAL TESTS[1]

By HAROLD E. BURTT

I. INTRODUCTION

During the spring of 1916 Professor Münsterberg gave a series of mental tests to the members of his large course in elementary psychology. The work was undertaken primarily because of interests in vocational psychology and an attempt was made to correlate the results not only with collegiate standing but with individual estimates of vocational aptitude. The same tests were subsequently given, in whole or in part, to a small class of Radcliffe students, to 31 members of a western military academy, to 40 employees of an Ohio clothing house, to 23 executives and salesmen of a large New England manufacturing concern and to 72 employees of one of the leading Boston department stores. In some cases employers' estimates of the vocational ability of the persons tested were available.

At the time of Professor Münsterberg's death the original data from the 460 subjects had been corrected and scored and certain correlations computed for the Harvard group.[2] The vocational aspect of the tests and the interpretation of results for other groups than the Harvard students was barely begun. At the same time more detailed materials for some of the tests were being worked out and various forms of new tests were being devised with a view to future standardization.

The entire data was turned over to the writer by Mrs. Münsterberg with a view to posthumous publication. The writer was in close touch with Professor Münsterberg and fairly familiar with his methods and purposes and, while it is impossible to do the matter justice, an attempt will be made to compute and interpret the results as Professor Münsterberg intended to do.[3]

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[1] From the Harvard Psychological Laboratory.

[2] A popular article based on this aspect of the tests was written by Professor Münsterberg for the *Harvard Illustrated*, 18, 170.

The following account will comprise six parts: (1) a brief description of the tests employed; (2) norms for the various groups tested; (3) correlations for the group of Harvard students of test scores with class standing and the intercorrelations of some of the tests; (4) the differential vocational sensitivity of the tests on the basis of the extremes of personal estimates as to vocational aptitude in the Harvard group; (5) the vocational aspects of the tests indicated by the results from industrial concerns; (6) suggestions as to other new forms of tests and general vocational possibilities.

II. DESCRIPTION OF THE TESTS

The test material was presented to the subjects in groups by means of printed blanks.[4] The thirteen tests used will be designated by letters of the alphabet.

Test A. *Free association.* Stimulus word (e. g. railroad, poetry) spoken by the experimenter. Subject writes a train of association words for periods of 1, 3 and 5 minutes in successive trials with different stimuli.

Test B. *Attention (intellectual).* Three hundred and fifty unspaced capital letters arranged in several lines, certain adjacent groups of letters forming a word. Subject underlines such words. For example in "hotbrdenexerfisaelieyur" are the words "hot, den, is, lie." There are 55 such words in the list. Time 3 minutes.

Test C. *Attention (perceptual).* Similar to the above, having 350 unspaced digits. Subject underlines adjacent pairs whose sum is 9. Thus in 65408618534927 are the pairs 54, 18, 27 whose sum is 9. Time 3 minutes.

Test D. *Construction by selection.* A list of several words such that by selecting one letter from each word the name of some famous American can be spelled. Thus: (1) *b*all, tu*r*n, e*y*e, l*a*rd, k*n*ife,—Bryan; (2) b*e*ar, roa*d*, p*i*ne, ro*s*e, h*o*le, tow*n*,—Edison. The italics are not indicated on the test blank. Five lists of this sort constitute the test. Time 4 minutes.

Test E. *Completion (intellectual).* Two hard examples for sentence completion, giving the first letter of each omitted word and indicating by asterisks the number of letters necessary to complete the word. Seven and nine words omitted respectively in the two selections. Time 2 minutes each.

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[3] The writer is indebted to Professor Münsterberg's secretary, Miss Wilkins, and to Professor Yerkes.

[4] The form of all the tests is such that they can be reproduced on a typewriter without the use of special drawings or charts.

Test F. *Completion (perceptual)*. A list of words having only the first and last letters given; thus: p-l, a-y, w-h. Subject fills in any number of letters to make the word. In a second list the first two letters of the words are given; thus: cu-, tu-, ai-, and the words are to be finished. Thirty words in each list. Time 2 minutes each.

Test G. *Word building* with the letters a, b, e, l, r. Time 3 minutes.

Test H. *Decision.*[5] A group of 4 lines of vowels such as the following:

E U U O O U U E A A E U U E A A E U U O O U U E
A U A O U U U O U A U O O U A U O U U U O A U A
E O U O U O A U U A U U U U A U U A O U O U O E
U E E U O A U E E A E U U E A E E U A O U E E U

In the above group U occurs 42 times and the other vowels 18 times each. Seven other groups on the blank have the following ratios: O 42, others 18; O 30, others 22; E 42, others 18; U 30, others 22; A 30, others 22; A 42, others 18; E 30, others 22. Subject looks at the sheet and judges (without counting) in each group as to the predominant letter. Time 2 minutes.

Test J. *Reasoning (relation)*. Twenty adjectives such as "busy, clumsy, cruel," printed in a column. Subject writes after each its opposite. Time 2 minutes.

Test K. *Reasoning (principle)*.[6] Three rows of vowels A, O and U such as the following:

A U O A A
A O U
A U U A O A A A U

The O bears a constant relation to the other vowels in each line (in this case the middle). Six similar groups embodying the following relations: fifth from the right end; before the first U (counting from the left); second after the first U; second after the second A; first before the third A; as many places after the first A as this is after the beginning. Six minutes to discover and write down the various relations.

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[5] Described originally in Münsterberg, H. *Psychology and Industrial Efficiency*. 1913. p. 86.

[6] This test was suggested by the Yerkes multiple choice method. *cf.* Yerkes, Robert M. The study of human behavior. *Science*, 39, 625.

Test L. *Reconstruction (perceptual)*. Nouns with the letters disarranged. Subject discovers the word represented. Thus: "ettrul," "idolcocer" are "turtle" and "crocodile." Eight names of animals and eight names of cities in the United States. Time 3 minutes each.

Test M. *Reconstruction (intellectual)*. A sentence with the first few words in the correct order but with the remainder arranged alphabetically, such as the following:
"The idea of mental tests is—abilities acquired and and compare discover demands inborn is mind of of practical the the the the them to to various vocations with." Two other selections of about the same length and difficulty. Total time for rearrangement of the three, 9 minutes.

Test N. *Sentence building* (used in place of test M with all but the Harvard group). Ten nouns and adjectives such as, "book, butterfly, green, house, picture, milk, serious, seven, smile, woman." Subject forms a sentence containing all these words. Two groups of this sort. Time 4 minutes each.

All the data except that for test N was corrected quantitatively and the results then transformed according to an arbitrary scale which varied for the different tests so that the final scores formed roughly a probability distribution with a minimum of 0 and a maximum of 10 points. For example in test B the correct underlining of 1-20 words gave a score of 0 points, 21-25 words 2 points, 26-30 words 4 points, 31-35 words 6 points, 36-39 words 8 points, 40 words or more 10 points. In this way a single digit from 1 to 10 represented the individual's performance in each of the 12 tests.

The tests occupied approximately two hours and in all cases were given in two sets on different days. About five per cent of the Harvard group were absent on each day and were given a chance to make up the work. None of the blanks were allowed outside the room, and as the total average score of those taking "make-ups" differed from the general average by less than two per cent, no appreciable error was introduced by this procedure.

In all the groups but two the tests were given by Professor Münsterberg. For the students in the military academy and the employees of the Ohio firm full directions were forwarded and a responsible person gave the tests.

III. GENERAL AVERAGES

The average scores in the separate tests for each group of subjects are given in table I. The successive rows indicate the 13 tests and the columns indicate the groups. At the head of each column is given the number of individuals in the group. At the bottom are the sums of the scores for tests B to L inclusive. A was scored by a slightly different method in some of the groups and the results are not strictly comparable.

A glance at the bottom row of the table shows that the rank of the five groups in the sum of the test scores is what might be expected on the basis of the selection of the groups. The Radcliffe students in an advanced course in psychology rank highest. The Harvard group ranks next as might be expected on the basis of selection. Then follow the military students in a secondary school who presumably were not as thoroughly selected by entrance requirements; the salesmen and executives of the wholesale concern, and finally the unselected clerks in a department store.

TABLE I

Test	Harvard (276)	Radcliffe (17)	Military academy (31)	Wholesale employees (23)	Boston dept. store (72)	Ohio dept. store (40)
A. Association.......	4.9	8.0	7.4	4.3	5.4	...
B. Attention (words).	5.4	7.0	4.1	5.1	5.5	...
C. Attention (letters).	4.4	7.9	7.0	4.8	4.1	...
D. Const. by selection	4.8	3.3	3.2	3.9	1.7	...
E. Sentence compl't'n	4.4	5.4	2.7	2.5	1.1	2.7
F. Word completion.	5.1	7.4	5.8	4.9	4.9	3.0
G. Word building....	3.3	4.9	2.9	2.3	1.5	2.1
H. Decision.........	4.2	4.7	4.4	3.9	3.5	...
J. Opposites........	6.7	8.8	3.5	4.5	2.5	...
K. Principle.........	4.5	2.6	2.5	2.5	1.6	...
L. Rearrange letters.	3.9	3.8	3.0	2.7	1.2	2.9
M. Rearrange words..	5.2	...	...	...	...	...
N. Sentence building.	...	6.0	6.4	5.0	3.6	...
Sum B-L............	46.7	55.8	39.1	37.1	27.6	...

If in the table we regard the Harvard group (which is by far the largest) as the standard and compare the others with it in respect to the various tests we note that the Radcliffe group is considerably superior (80%) in test C and considerably inferior (42%) in test K. The military academy group also excels the Harvard in C (59%) and falls farthest below it in J (48%) and K (45%). The wholesale employees fall farthest below the Harvard averages in K (45%) and E (44%), and the clerks are most inferior in E (75%) and L (69%). The most noticeable differences, then, are in test E, sentence completion,—frequently mentioned in the literature as a test of intelligence,—and in tests J and K which involve reasoning and the ability to perceive relations.

It is possible to examine the data from another standpoint, namely the ranking of the average scores for the ten tests within a given group of subjects. Thus test B yields nearly the highest score of the ten in every group. So does C, with the exception of the Harvard students. E stands relatively high in rank with both college groups, but relatively low with the other three groups. H ranks rather low with the college groups and relatively high with the others. J ranks the highest of the ten for the college groups and fourth or fifth with the others. K ranks very low for all the groups except the Harvard, where it ranks fifth. Here again the most striking thing is the superiority of the college students in tests E and J, sentence completion and opposites, tests of a distinctly intellectual order.

The ranking of the tests in the various groups do not intercorrelate highly except in a few instances. The ranks of the ten tests for the wholesale group and for the department store employees correlate to the extent of .70 ±.14 by the foot-rule formula. The military group correlates with each of these to the extent of .62 and .64 ± .14. All other correlations are less than .30.

IV. Correlations

Various correlations were computed for the Harvard group. It seemed interesting first of all to compare efficiency in this set of tests with class standing. Inasmuch as the group was composed of members of the four undergraduate classes the marks for the freshman year were taken as a standard. Arbitrary values were assigned to the marks of A, B, C, etc., and an average coefficient determined which represented the individual's college standing for the year. These coefficients were then compared with the sum of the test scores for the different individuals. If the 276 members are distributed in tertiles of rank in both respects the results are as shown in table II.

TABLE II

CORRELATION OF CLASS STANDING WITH SUM OF 12 TESTS

	1st tertile tests	2nd tertile tests	3rd tertile tests
1st tertile class..............	43%	35%	22%
2nd tertile class..............	33%	28%	39%
3rd tertile class..............	24%	37%	39%

There is evidence of some correlation but it is not very striking. If the ranks are correlated by the foot-rule method the coefficient is .127 ± .026. If class standing is correlated with the sum of the tests E and M (which perhaps lay more stress on intellectual processes) the coefficient is somewhat higher (.178 ± .026). This rather low correlation coincides with the results of many similar studies. It suggests the fact that many students (in freshman year at least) do not work at their maximum level of intellectual efficiency.

Certain of the tests were correlated with one another, with class standing and with the sum of the tests by a rough use of the foot-rule formula. The only point of interest is that the sum of the tests correlated most highly with tests B and C,—the two attention tests. This suggests the fact that in these two tests the initial adaptation to the conditions of the test is slight and they are thus more reliable than other single tests in hasty application.

V. VOCATIONAL IMPLICATIONS OF THE TESTS IN THE HARVARD GROUPS

The Harvard students who took the tests were asked to give an estimate of their own ability as executives, salesmen and promoters or inventors. Each man was to give himself a total of 100% in the three fields. Then groups were formed on the basis of extremes of such estimates for a comparative study of the vocational sensitivity of the tests. Thus a group was formed of approximately 20 students who estimated their ability as executives at upwards of 80% and such a group contrasted with another formed of about 20 who estimated their executive ability at 10% or less. Similar groups of about the same numbers were formed for salesmen and inventors. Individual estimates of this sort would undoubtedly be unreliable in the middle range, but it is probably safe in a preliminary survey, *to attach some validity to the extremes* of personal estimates.

The average scores of each of these six groups for each of the twelve tests are given in table III. The successive columns give the averages for the 12 tests A to M. The first row gives the average in those tests for the group of good salesmen, the second row for the group of poor salesmen and the third row the per cent by which the figure in the first row exceeds the corresponding one in the second, i. e. the per cent by which the good salesmen are superior to the poor in the various tests. Similar figures are given in subsequent rows for executives and inventors.

TABLE III

Test		A	B	C	D	E	F	G	H	J	K	L	M
Salesmen	Good............	5.7	6.1	4.8	4.9	4.0	6.0	3.6	3.6	6.8	4.8	5.1	5.2
	Poor............	4.8	4.9	5.5	5.3	5.7	5.5	3.2	5.1	6.3	4.4	3.2	4.5
	%superiority good	19	24	−13	−8	−30	9	12	−29	8	9	**59**	16
Executives	Good............	5.0	5.0	4.7	4.5	5.2	4.7	3.1	4.2	6.9	3.7	3.5	5.4
	Poor............	4.2	4.3	4.3	2.8	3.2	5.1	3.1	3.2	6.3	5.2	2.9	5.2
	%superiority good	19	16	9	**61**	**62**	−8	0	**31**	9	−29	21	4
Inventors	Good............	4.0	4.5	5.2	3.3	4.4	4.8	2.7	4.4	6.4	5.2	2.2	5.2
	Poor............	4.1	5.3	5.8	3.7	3.5	4.8	3.1	3.7	6.2	3.6	3.4	5.3
	%superiority good	−2	−15	−10	−11	26	0	−13	19	3	**44**	−35	−2

A glance at the rows of per cents difference shows the tests which in the above group are most sensitive to the three vocational aptitudes. In salesmanship the most marked results are with test L (rearrangement of letters). In this test the good salesmen are 59% superior to the poor and the difference is 3.2 the probable error of difference. The next greatest difference is in test B (attention-intellectual) with a difference of 24% which is only 1.8 the probable error of difference. The superiority of the good salesmen in the other tests is slight or negative.

With executives there appear three fairly sensitive tests,— D (construction by selection) and E (sentence completion), with differences of 61% and 62%, almost equally sensitive, and H (decision), with a difference of 31%, sensitive to a somewhat lesser degree. The three differences are respectively 3.6, 3.3, and 2.0 the probable error of difference.

Only one test appears at all sensitive to inventive or promotor ability, viz.: K (principle). The difference is 44% and is 3.4 the probable error of difference.

Thus, assuming a certain validity in the methods of selecting the above groups, there are one or more tests which appear somewhat sensitive to each of the three vocations in question. A further problem is the comparison of these figures with results of the application of the same tests to efficient and inefficient salesmen and executives in actual practice.

VI. VOCATIONAL IMPLICATIONS OF THE TESTS IN THE INDUSTRIAL GROUPS

The employees of a New England wholesale concern who were given the tests were also rated by their managers with reference to ability as salesmen or executives. It was thus possible to select efficient and inefficient groups of each sort,—the only difficulty being the small size of the groups.

Thus comparing the test results of the 5 best salesmen with those of the 5 worst and computing the data as in table III there appear possibly significant differences in the following tests:

SALESMEN

Test	C	D	F	J	L
Good	7.5	5.5	7.5	5.5	3.5
Poor	4.0	2.4	4.0	2.8	1.6
% superiority good	87	130	87	96	120

The good salesmen actually score more highly in most of the tests but the greatest differences are manifest with D (construction by selection) and L (rearrangement of letters). The latter is the test which appears most clearly differential of salesmanship ability in the Harvard results.

Similarly comparing 4 good executives with 3 poor ones: Here although the good executives are superior in most of the tests, the greatest difference is for E (sentence completion) which yields the greatest difference also in the Harvard group.

Four of the tests, E, F, G and L were given to 40 employees

EXECUTIVES

Test	E	G	K	L
Good	6.0	5.5	4.5	5.0
Poor	1.3	2.0	1.3	2.0
% superiority good	**360**	175	246	150

in an Ohio department store. A person familiar with the individuals selected 10 good salespeople and 10 poorer, also 10 good executives and 10 poorer. The results for the salespeople are negative. In none of the tests are the good salespeople appreciably superior on the average. This is possibly due to the small size of the group and its selection. The groups of salespeople were extremely variable, having a mean variation of over 100% in several instances. With the executives the results are clearer as indicated by the following:

EXECUTIVES

Test	E	F	G	L
Good	4.8	3.4	2.4	3.8
Poor	2.2	2.4	1.2	2.0
% superiority good	**118**	42	100	90

The good executives are superior to the poor in every test but especially so in E (sentence completion). It is to be noted that E gives the most distinct results in the two studies just mentioned.

The salespeople in the Boston department store who took the tests were selected by the superintendent so as to give a group of 35 efficient and one of 35 inefficient clerks. The tests which yield the greatest difference in the average scores of the two groups are as follows:

SALESPEOPLE

Test	D	E	F	L
Good	1.9	1.4	5.5	1.5
Poor	1.4	.9	4.2	1.0
%superiority good	36	**55**	31	**50**

Test E (sentence completion) and L (rearrangement of letters) show the greatest sensitivity to salesmanship ability in this group. The latter shows similar sensitivity in the other studies just mentioned.

These results may be, of course, somewhat invalidated by the small number of individuals in some of the industrial groups and by the use of personal estimates of ability in the Harvard group, but it is a significant fact that certain of the tests are found to be consistently differential of vocational aptitude in all the various groups investigated. Test E (sentence completion) proves to be in the above study a test par excellence of executive ability, and test L (rearrangement of letters) of ability in salesmanship. The results manifestly warrant further investigation.

VII. Suggestions for the Future

In addition to the above, a number of new forms of tests were being devised by Professor Münsterberg with a view to further vocational study and standardization.

1. Test of observation. A series of numbers arranged thus:

12	3	14	9	5
7	15	17	2	21
22	1	8	11	18
24	6	13	23	16
20	25	10	4	19

involving, however, numbers from 1 to 100 instead of merely numbers up to 25. The subject marks numbers 1, 2, 3, etc., in order up to 100 with a time limit.

2. Test of foresight. A labyrinth made of letters x and o, thus:

Z	o	o	o	x
o	x	x	o	o
x	o	o	o	o
x	o	o	x	x
o	o	o	o	A

but much more complicated and involving 224 letters. The subject starts at A and by tracing on the o's reaches the opposite corner Z.

3. Test of suggestibility. Two columns of words at opposite sides of the sheet, thus:

	tree
	bird
	cat
dog	ink
	blue
	grass
shirt	boat
	collar
	eye
	library
book	loud
	truth

The subject has to quickly indicate which words in the second column are on the same line as the various words in the first column. For example " ink " is on the same line with " dog," but the word " cat," a line above, is more strongly associated with " dog " and may act as a suggestion and appear on the same line. Similarly " collar " is a line below " shirt " but more strongly associated with it than " boat." Long lists of this sort may give an index of suggestibility.

4. Test of " steadiness." A selection beginning as follows: phree stchraute blyoovcextbhl rhyiusi elliffmee tsrheaclslt bluoysrce pirte. By reading the alternate letters of each word beginning with the second, one may decipher the sentence, " He that loveth his life shall lose it." In other material every third or fourth or fifth letter is to be read. Thus: obnvttrweovniugxcuiecvbitpuythercuexciurswe spells " together " by reading every fifth letter. The ability to hold a given setting and rapidly decipher a fairly long selection is an index of " steadiness."

5. Test of recognition. Two stories differing only in minor details. The subject reads them successively and in the second indicates the points that have been changed.

6. Test of division of attention. A selection in which alternate words beginning with the first form one story and alternate words beginning with the second form a second story, thus: " I The want little to house consult where you, I Professor was Brown, born, about and a in most which baffling I case passed of the sudden earlier death years under of suspicious my circumstances. life." The subject reads the selection intact without pause and then reproduces the two stories as far as possible.

The ultimate intention of Professor Münsterberg was to arrange two sets of tests,—one for vocational guidance and one for vocational selection. In the former case the individual was to be provided with a set of blanks for each of the tests used. An elaborate and detailed set of examples for the given test was to be given on the first sheet and the subject was then to do the tests on the remaining sheets after having the method made clear by the examples. Materials arranged in this way were to be provided for each test. Then by comparing his results with vocational norms for the given tests the individual could determine his aptitude. A somewhat similar set was to be provided for employers interested in vocational selection, although the two sets would not be identical. Tests involving suggestibility, for example, would not be feasible for auto-experimentation.

In providing these sets the tests which proved in the above and in other studies to be the most sensitive to vocational aptitude were to be standardized with more exhaustive material and vocational norms determined. It would seem that of the twelve tests used in the above investigation the most profitable ones to standardize would be tests of rearrangement of letters for salesmen and completion tests for executives.

PSYCHOLOGY AND BUSINESS

By F. C. HENDERSCHOTT,
Executive Secretary of the National Association of Corporation Schools

Because of my position as the founder of The National Association of Corporation Schools or, perhaps more correctly stated, as originator of the idea upon which the Organization is founded and, further, because of my connection with the Organization since its inception as Executive Secretary and the working officer, you have asked me to furnish an article for the Journal of Applied Psychology setting forth a resumé of the problems and a means of solving them in connection with the human element in industry.

So far as I am informed there is not sufficient record of actual accomplishment, by means of psychological tests, to warrant definite conclusions as to the value of such tests in the selection of individuals for definite tasks. Something has been done, more has been undertaken. Perhaps Walter Dill Scott, in the course of a year or two, will give us, from his psychological laboratory at the Carnegie Institute of Technology, something definite, something conclusive, something practical as to the application of psychology in efforts to pre-determine the inherent ability plus the development of the individual. Having accepted such methods of analysis as worthy, having determined that the information gained can be applied in a practical way, then vocational placement efforts may be made valuable.

At the moment, however, while certain of the larger industrial corporations of the United States have carried on experiments, psychological in character, in connection with their employment divisions, it is doubtful if there have come into existence any accepted standards which may be safely relied upon to justify the hope that psychological tests may prove of any considerable value in the employment departments of industrial institutions.

Other than efforts to pre-determine what particular class of work individuals are best qualified for by natural endowment, through training, and other development with experience as a basis, there are six distinct problems upon which information is sought in relation to the individual and his work.

(1) A lack of understanding, almost universal in extent

upon the part of the individual, as to the law of rewards.

(2) The absence of standards, sufficiently understood at least, by which the individual can measure his comparative value as a worker and thereby determine his position among his fellow men.

(3) A lack of the element of leadership—or a lack of knowledge of methods through which latent talent for leadership may be aroused and developed.

(4) A lack of information about or understanding of the earlier periods in the history of the world and of how civilization has developed.

(5) A lack of civic vision on the part of both executives and workers of industrial institutions.

(6) The lack of an equitable system to insure a just distribution of rewards earned.

In discussing the first of these classifications, the average youth seeks immediate reward. If his efforts find a reward at the close of the week stimulation is relatively easy. If the reward is delayed until the end of the month a less number will participate in the effort. If the reward be further delayed for a period of a year only the exceptional individual can be interested. And should the development take the form of the ultimate and larger reward which is gained only through the more complete utilization of the individual's latent talents accompanied by unusual exertion for a long continued period, only the so-called "genius" possesses vision sufficiently strong to fully appreciate the fact that reward begins with development and keeps pace to the end.

This condition undoubtedly accounts for the fact that the positions which pay the largest salaries usually seek the man, whereas the positions which pay smaller wages are eagerly sought for by the crowd.

If psychology can be applied so as to stimulate vision and to create a more complete understanding as to the law of rewards, the progress of the human race and especially the progress of industry, dependent upon human elements, will be much accelerated.

Second: Because of faults in history, and especially because of the eulogistic character of the biographies of men who have accomplished unusual things, the average boy is prone to reach a decision, more or less final in character, which rather depreciates his individual characteristics and possibilities.

The average youth does not understand the mistakes; failures with their resultant depression and those other elements which go to make up the negative side of character and are common to all mankind and comes to believe that men of the type and position of Washington, Lincoln, Clay and Webster possessed great inherent qualities which he does not possess and can not hope to attain in his individual growth. Oftentimes the youth goes even further and conceives deifying qualities in contemplating the character and accomplishments of men like Edison, Roosevelt and Burbank, whose work is still unfinished.

Again, it is equally true that the average boy has but small if any real understanding as to what his earning capacity really is and just what would be required of him to increase that capacity and the extent to which development might be possible.

It is a human failing to believe that we are underpaid for our work, but, should a situation arise through which the individual could form an impersonal judgment—if such a situation could be brought about—it is very doubtful if any large percentage of individuals would give themselves a job at the wages which they are drawing. Especially is this true in relation to employees of institutions large in character, where judgment and vision might prove the determining quality.

This condition is at the bottom of the unrest of the so-called laboring classes. If, by the application of psychology, a system could be determined through which each individual in the institution might feel a reasonable assurance that his reward in the form of wages or salary is fair and equitable in comparison with the rewards meted out to other individuals who collectively make up the working forces of the institution then unrest would be minimized or would cease and the wage problem would become more scientific and better organized.

Third: The moment one develops the characteristics of leadership he draws away from the crowd. The crowd never progresses. The individual finds himself in a new and strange environment, a situation comparable to a sudden ascent to the top of a tall building. There is not sufficient time nor opportunity to readjust his vision. So in the development for leadership, the individual finds himself in strange surroundings with no familiar guideposts, no familiar standards for purposes of comparison.

Many fail through lack of adaptability. Many more fail because of an over-estimation of their individual importance. Other failures may be attributed to uneven development or inherited tendencies which result in a passion for autocratic power and lack of sympathy with the less fortunate of their fellow men.

A better understanding of what characteristics are demanded in leadership and how latent ability may be aroused and developed, would materially lessen the number of individual failures. Here is an opportunity for the application of psychology to the betterment not only of the individual, but also of industry, which would result in a more constant and permanent advancement of society as a whole.

Fourth: Because of religious training and because religious ideals lie in the field of belief rather than in the field of knowledge, there is no well conceived information as to the earlier periods of the human race.

The more modern, and especially the more bold of the historians, are inclined to the theory that man's first stage was that of savagery and that the human race came out of that stage through the discovery of fire and the use to which this force could be put. The development of this theory, however, seriously upsets many religious convictions with the resultant condition that knowledge of the earlier period is contradictory and involved with religious beliefs.

If man did develop out of a stage of savagery little better than that of the more intelligent of the beasts and if fire, the conception of the gods and their powers, and finally the conception of the one God of Spirit has been a large factor in the progress of the human race toward a higher and more godlike condition, then it is time that myths and beliefs, which have outlived their usefulness, were swept aside.

The fact that a majority of scientists and psychologists are classed as agnostics and atheists may be attributed to an effort on their part to differentiate as between the field of knowledge and the field of belief.

It is not that the scientists and psychologists reject God and the immortality of the human soul so much as that they refuse to accept a certain theology and reject creeds, the teachings of which are sincerely believed and devoutly adhered to by the masses, but nevertheless beyond the horizon of the human mind.

The youth who has thorough information as to the basic laws of the physical world and likewise the basic laws of the mental world is constrained to attach greater importance to the results of scientific investigation—as for example—to Watt's discovery that through the application of heat to water there was secured a powerful agency of energy, than will be attached by the youth who is prone to believe that such a revelation is supernatural and the will of a Supreme Power rather than the result of human activities.

If an application of psychology can be made to this condition so that human minds, especially the minds of the young, will be freed from the distracting influences which emanate from the field of belief to contradict well authenticated information in the field of knowledge, there must follow a more logical and a more permanent progress toward better standards in living.

Fifth: Industry, originally carried on in the home, has assumed new and strange forms. When industry was a feature of the home life it was largely devoid of profit and was administered to meet the needs of the family or at best the community. But through the use of manufactured power and the assistance of engineering skill production has ceased to be the predominant problem in modern life and competition has reached a state of decay. This condition has given rise to the modern corporation. It was natural that those who guided and administered corporation activities should have sought profits, as under the second stages of industry, or after it was removed from the home and became a community affair.

Inability to produce enough to satisfy the demand makes marketing by the competitive system possible. The law of supply and demand became firmly established, but when production exceeded demand, at least such demand as then existed, competition was no longer effective.

The new period of co-operation is not yet fully instituted. The "growing pains" of this period produced the Sherman Law and also an antagonistic attitude on the part of consumers toward big business.

It is evident to thoughtful, reasoning mentalities that marketing must be accomplished on a basis which will return a fair and just profit to the producer if there is to be permanent prosperity. Here again an application of psychology may be made in determining standards—not only standards of profits, but standards of production, standards of distribution and standards of ethics in marketing.

Also, there is required the development of a civic vision, which will add a more complete understanding on the part of the people as a whole, as to the rights of the producer, the distributor and the consumer. The tendency has been, even among larger industrial institutions, to disregard factors other than those contributing to their own interest and their personal prosperity. Now it is a self-evident fact that when our transportation systems are busy and prosperous our factories are operating at capacity, and there is a market for the produce of our farms and on a profitable basis. In other words, individual industrial institutions cannot conduct their businesses apart from the peace and prosperity of industry as a whole.

There is need of a civic development which will visualize this picture and to the end that there may be united effort and a willingness to co-operate, not to the end that there may be profit and prosperity for the individual, but for all industries and all people.

Sixth: Under this classification the discussion takes us into the field where reign the contentions of the socialogist, the socialist, the I. W. W. and all others who are warring with the established order of things. Theoretically and ideally there should be equality of opportunity and equality of reward according to merit! Is this possible?

That there cannot be equality of reward without determination of merit has been amply proved. The theory that all should contribute to a general bread-basket from which all may draw according to their needs has been many times proved a Utopian theory but impossible of realization. As against this practical demonstration of the fallacies of the ideal relation of "one for all and all for one," there is the other and more selfish side of the situation, namely, each individual securing through property rights and superior development all that he may be able to force from the general bread-basket into his own pocketbook.

Somewhere between these two extremes lies the true solution. It may be in collective stock ownership in which the workers share, it may be in retirement pensions, it may be in group insurance, sick and death benefit plans, thrift organizations and the many other activities commonly known as welfare movements. Or it may be in part in this kind of activities and in part through plans and systems as yet indeterminate. But there is a growing school of thought continually enlarging in its scope, which is firm in its convictions that property is not the first consideration in the attainment of happiness, but is rather a means to an end, and that property must be relegated to its proper sphere of usefulness and not made the continuous bone of contention. To my mind here is another opportunity for the application of psychology, perhaps having as its object a unanimity of thought rather than definite labor legislation.

It may thus be seen that the opportunities for the application of psychology, through industry, to the end that organized society may be improved and the happiness of the individual increased are almost endless and the promise of resultant benefits very great.

IMPROVING BUSINESS CORRESPONDENCE

By H. N. Rasely, Correspondence Supervisor,
Norton Company, Worcester, Mass.

Each day letters are playing a more important part in the life of every business firm and the practice is growing. Letters are coming to be more and more depended upon to complete many of the important transactions and practically all of the smaller ones. Some organizations have found it possible to get along without the aid of salesmen, but none would attempt to exist without the aid of the letter.

This widespread use of the mails has brought about a condition which most of the progressive business men are just beginning to realize—there is a scarcity of well trained business letter writers. The schools have not as yet caught the true significance of the situation. This is not to be wondered at since schools that previously have given the teaching of business subjects any attention have, for the most part, followed the needs of the business firm in so far as they knew what the needs were. Since business itself is only beginning to realize what it means to have well trained correspondents the fault cannot be laid at the door of educational institutions.

Skilled labor is a term that does not need to be explained. The employer has demanded a certain amount of skill on the part of those who apply to him for work of a particular nature. The stage has now been reached where he must make the same demand of those who write his letters.

The letter is the delicate thread of contact that exists between the firm and those who use its products. Because of the complexity of commercial relations today there are many users of products, who know the manufacturers only through the letters which are received from them. Personal contact is impossible; the letter has been substituted and it must be relied upon to create the same effect as the personal contact would. This condition has put some rather heavy burdens upon letter writers. To equip them to carry this load successfully, it is necessary that a well defined course of training be given to those who are to be entrusted with this important task.

One organization, realizing this fact, has for the past two years been actively engaged in strengthening its letter writing force by giving each man a certain amount of training in dictation and then subjecting his work to the criticism of a department organized for the purpose. Concentration on a subject of this kind for so long a period has accomplished a great deal more than was conceived of when the work was originally started. Lost motion and waste energy in many cases have been eliminated which has meant a direct saving of money. This is in addition to the other results which have been obtained but which are more or less intangible. The indirect benefits were the ones originally aimed at. That the effort has been repaid from this one source alone has been demonstrated to our satisfaction, but the scope of this article does not allow of space being given to prove this statement.

It is the intention, in this article, to bring out in a brief way some of the things which have been accomplished since this work has been in progress, and to show the method of attack.

The firm should be regarded as having two representatives, the personal and the written. The personal representatives in the case of this organization probably average from 200 to 300 calls a day. The written representatives make between 700 and 800 calls a day, for this is the number of personally dictated letters which leave the mailing room each day on an average.

Throughout the entire process the letters, or written representatives, must perform duties identical with those demanded of the personal representatives. This similarity of purpose or function should always be kept in mind.

Some of the things which letters are called upon to do are to collect accounts, to quote prices, to make adjustments, to sell goods direct, to give information regarding shipments, and many other subjects. The written representative has certain disadvantages in that the man behind the letter does not know personally the one to whom he is writing. He cannot judge of the immediate effect of his words upon the reader, which, were he in personal contact with his party, he could detect by noticing his facial expression. In addition many things can be said in conversation which would be regarded as aside from the question at hand, were the same thoughts expressed in writing. The letter must produce the effect of a conversation without actually being a reproduction of the conversation.

It is necessary that business letters be interesting, that they have a friendly touch, and what is of greater importance they must make an endeavor to impress their message upon the reader. It is the purpose of the letter to drive home the fact or facts contained in it or else the letter has very little excuse for its existence.

Those who receive and read business letters should realize that the ones who wrote them were live, thinking individuals, people who were interested in their work and in their customers. If the letter writer cannot take this attitude then he should not be allowed to send out these impression creators. In our case it is desired that those who read our letters should experience the same reactions that they would were they to come into personal contact with the ones who wrote them.

It is possible to compare a letter to a person. When we meet or talk with a man who has vim and life an impression of that person is made upon us. We feel that we are under the influence of a character. A totally different impression is made when we meet some spineless, shiftless, characterless individual. In fact the difference is quite noticeable. These same differences in impression can be made by letters. A letter can be said to have character or to lack character. Every time a letter is read an impression is made. People are unconsciously analyzing each other in their minds and letters meet with the same treatment. That this is true, the writer has proved for himself by noticing the many hundreds of letters which have come back in answer to those which have been sent out. This belief is further strengthened by the result of a field investigation where many purchasing agents of very prominent organizations as well as those of the lesser type were interviewed.

The person selected for dictation work is first interviewed by the Correspondence Supervisor. He is then taught to use the phonograph which is the dictation medium and is kept at it until he thoroughly understands how to use it. Clear dictation is very essential in order that what is said may be transcribed in a minimum amount of time, thus keeping the operating cost as low as possible.

The next step is to give the new dictator a very complete idea of the requirements and just what will be expected of him. It is then necessary for him to study a 70 page manual which contains instructions bearing directly on his work. This manual fills a very important place in the daily life of those who write our letters. Each one has a copy of it in his desk for ready reference.

When this ground has been covered the new dictator is given a number of letters to which he is required to dictate answers. The dictation is transcribed and is later criticised in company with the new dictator so that he will know just what to expect in the way of supervision of his work.

Should his work up to this stage demonstrate that he is not fitted for letter writing, he can be dropped from the list of eligibles with recommendations as to what he had better do in the way of further training for himself if he wishes to be considered again at some future time.

Should he show a certain amount of aptitude, he is added to the dictating force but his name is kept on what is called our active list and nothing that he writes is allowed to leave the organization until it has passed the department of supervision. His work is followed in this way until we are satisfied that he can dictate letters that will be truly representative of the organization. If he does not develop satisfactorily during this additional trial period, he can then be dropped from the regular force with suggestions as to how he can better fit himself for the work. For people who have reached this stage there is most always a certain amount of minor dictation work which they can take care of satisfactorily in which case they are retained on the force.

When the new dictator reaches proficiency, his work comes up for criticism only periodically.

The procedure outlined is the same whether the new dictator has had experience elsewhere or not. It has been the writer's experience that the raw recruit reacts more quickly to the treatment than the person who has had correspondence experience, as we know correspondence experience today. The green man is not handicapped by habits wrongly formed.

A record is kept of each man's work so that it is possible to keep in touch with his progress at all times. The following figures will show just how closely this can be done.

Date	Letters read	Criticisms	%	Rewritten	%
January, 1917................	217	106	48.8	29	13.4
February, 1917................	149	89	59.7	23	15.4
March, 1917................	310	62	20.0	11	3.5
April, 1917................	252	43	17.1	7	2.8

Pressure on the points wherein this dictator was weak enabled him to make the improvement noted for the months of March and April.

The work of criticism of the dictators is carried on by means of a slip on which are given the points wherein it was found that our letters were faulty. The following is a list of these:

Clearness
Incomplete information
Involved
Awkward
Conciseness
Arrangement
Correct words
Choice of words
Courtesy
Tone

Sentence length
Needless words
Unnecessary information
Repetition
Emphasis
Policy
Subject
Delayed answer
Construction
Correctness

This list could be made much longer but the things which we have to contend with group themselves very nicely under these headings. When criticisms are necessary the principle violated is checked. The slip is then attached to the letter to which it applies and sent to the dictator. On the slip a space is given for remarks, and suggestions for improvements are written in this space. A criticism is never made unless the one making it can help the dictator improve the passage or passages under consideration.

It would be possible to make criticisms in pencil on the letters themselves. This is expressly avoided as every one has a certain pride in his work and to see it marked up is discouraging. There would undoubtedly be natural resentment to the work of criticism if this scheme was followed.

Needless words, stereotyped phrases, trite expressions many times spoil what otherwise might have been a good letter. It can safely be said that the character of a letter is often simply smothered because the writer has followed the same old humdrum, beaten track by employing forms of expression which have been used by thousands of so-called business letter writers for many years past.

Recently the writer received a large number of letters from one concern for the purpose of criticism. All were literally filled with such phrases as "valued favors received," and "thanking you for same." The majority finished with some form of the stereotyped participial closing of which the following are a few:

"Trusting that we may have the pleasure—we remain"
"Looking forward with pleasure—we remain"
"Regretting our inability—we remain"
"Thanking you for your prompt attention—we remain"
"Thanking you for your kindness—we remain"

Imagine a personal representative bringing his visits to a close with such meaningless expressions as those mentioned.

In addition to what has been spoken of, a letter must be clear, courteous and concise before it can be said that it is complete.

When we say clear we mean it should be immediately clear to the one who reads it. It should not be necessary for him to stop to study any passage. Many times a correspondent will contend that a letter is clear but what he means is that it is clear to him. That he knows what is meant does not signify that the reader will. Lack of clearness has often led to misunderstandings and misunderstandings are many times responsible for loss of time and money. Every thought must be so expressed that only one interpretation can be taken from what is written.

Involved expressions are often due to long sentences and for this reason the long sentence should be avoided. Not only do long sentences lack clearness in the majority of cases, but they are hard to read.

Example: "We would thank you for your telegraphic advices in this matter so we may be enabled to give our customers some idea of what they may expect as to delivery as prompt as possible."

The following is just as clearly expressed and the sentence consists of 24 words instead of 34.

Revision: "Please telegraph your reply to us so that we may be able to give our customers some idea of when they may expect this material."

By short sentences we do not mean that they should be too short, for sentences can be so short that they are curt. The style which makes use of moderately long sentences and short sentences is best.

Big words often prevent clearness. The correspondent should choose the simple words heard in daily conversation. These are necessary for the average person and are always well received by the highly educated. The person who uses big words is seeking expression and loses sight of impression. The purpose of the letter is to impress the reader. Ideas are wanted and not mere words.

An example or two will bring this point out more forcefully.

Examples: "We can readily understand how the ineffable effect of this order must have placed you in a perplexed condition."

"It is not our desire that you hold this shipment, but on the contrary a direct antithesis of the case is desired."

To the average reader of business letters these sentences would not mean anything until after he had consulted a dictionary.

Awkward sentences are responsible for lack of clearness. An example will make it more clear why this is so.

Example: "The last two items are for cup wheels in which connection and if other than straight cups are required, we should receive a fully dimensioned sketch."

Revision: "The last two items are for cup wheels. If other than regular cups are required please send us a sketch showing full dimensions."

The use of terms that are not familiar to the reader also hinder his obtaining a clear conception of what was in the writer's mind.

Courtesy was mentioned as one of the fundamental principles of all letter writing. The correspondent should always be sincere and direct. If he has made or will make these two qualities part of his everyday life they will be reflected in his letters.

A discourteous letter or even a sentence can do more damage than can be repaired in a long period of time. Discourteous letters can destroy accounts that have taken considerable effort and large sums of money to acquire.

Quite often a correspondent is tempted to write a cutting answer to a letter that contained abuse and meanness. The dictator's Golden Text should be: "A soft answer turneth away wrath." He dare not give way to his feelings to the extent of writing a letter the equal of which he received. It will only prolong a disagreeable situation. The letter writer should bear in mind that a letter fight is the worst kind of a quarrel. It may never be possible to straighten out satisfactorily the ill effects which are likely to result from such a slip as this.

Sarcasm and sharp language have no place in the business letter. They merely tend to make the reader angry and it is not possible to do anything with a person when he is in that state of mind.

A grouch is an abomination. He cannot radiate sunshine and should not be allowed to give expression to his ugly spirit in letters. The business firm is jeopardizing its permanent success, or the amount of success it might have attained, in proportion to the number of such decided misfits as are carried on the payroll.

Patience is another virtue. Often times a customer will persist in maintaining a certain stand simply because the letter writer has not made his side of the case as clear and convincing as he might have. In other words he has not caused the reader to see his side of the case.

Another fundamental principle is conciseness. Only enough words should be used as are necessary to make the meaning clear. All of the information needed should be given, but no more. One large corporation in having their correspondents omit from their letters all needless words and meaningless expressions has found that an estimated saving of $18,000 a year is made. The following example will show how the principle of conciseness is violated. In the revision all the information necessary for the complete understanding of the reader is given.

Dictated	*Revision*
"The Inspection Department has examined the wheel and finds it a grade R Crystolon wheel. They report that they cannot understand how this wheel got in with any 36 grade J Crystolon wheels, as its general appearance is quite different from them and they feel sure that the Grading or Inspection Departments would have noticed it at the time."	We find that it is a grade R Crystolon wheel. As it is quite different from a 36 grade J wheel it should have been noticed before shipment was made.
(59 words)	(30 words)

Conciseness in letter writing does three things:

It saves the correspondent's time in dictating
It saves the operator's time in writing
It saves the customer's time in reading

The following are examples of needless words which mean practically nothing. These can be found in a large number of letters written each day by the majority of business correspondents:

"Acknowledging receipt of yours of the above date we are pleased to advise that"

"We wish to advise that due to the fact that"

"In reply we wish to state that"

"In connection with this we wish to call your attention to the fact that"

Another important principle of letter writing is correctness and it should be considered from three angles:

Correct form
Correct language
Correct information

By correct form, we mean the appearance of the letter for appearance is often responsible for first impression.

All letters must be grammatically correct and if the information is not correct there is danger of losing the confidence of the one being written to.

By creating the right dictation habits the correspondent is able to concentrate at the time of the dictation instead of waiting till after the letter is written before doing his real thinking. This saves the expense of revision.

That this saving through the establishing of habits of dictation is worth while is made evident by the following tabulation. This is a comparison of the number of letters rewritten during July, 1916, with those rewritten during the month previous to the writing of this article:

Month	Letters written	Total	%	Fault of operator	%	Fault of dictator	%
July, 1916....	7,548	222	2.9	74	33.3	148	66.6
April, 1917....	10,143	141	1.4	58	41.1	83	58.8

In the force which handled this work during April there were six girls whose experience in our employ was not more than three months. In some cases it was less than that, so this result is still better with that consideration.

The new transcriber or operator is likewise given a course of training. The method is similar to that followed in instructing the new dictator. For the girl there is a manual of some 70 pages and it is written in such a way as to answer practically every question which will come up in her letter work. Each girl makes a copy of the book for her own use and each page is talked over with her by one of the assistants in the Correspondence Supervision Department. She is given time to make a study of the manual and is then required to take an examination that consists of 100 questions which are so designed as to bring out the points which are not clear in her mind. Through this means we are sure that she has learned the correct method for writing our letters. The time which is usually given to breaking in is reduced and the girl is brought more quickly to the point where she is efficient and can realize maximum production.

The letters which the new girl writes are subject to inspection and not one is allowed to reach the dictator until it has passed through the department of supervision. In this way all corrections can be made, for the girl is not allowed to get her experience at the expense of the time and temper of the dictator. Recently we have had a turnover in our Transcribing Department of about 50%, due to the drain on the department through promotions into secretaryships and other positions. Despite this turnover the dictating force did not realize that any changes had been made for their work as it came back to them was no different from that which the experienced girl turned out as far as the dictators were concerned. Everything in connection with the typewriting of the letter has been so standardized that the girl follows the same rule whether she is working for an official or for an order clerk.

In the supervision or inspection of the girls' work slips are used similar to those used for the dictators. The points on which we find it necessary to make criticisms are listed in the following columns:

Date
Address
Subject
Signature
Spelling
Punctuation
Tabulations
Abbreviations
Capitalization
Numbers
Amounts
Grammar
Reference marks
Margins
Uneven touch
Strikeovers
Erasures
General appearance
Titles
Spacing
Miscellaneous

The method of criticising the operators is the same as that in the case of the dictator. All criticisms are made on the slip and if it is necessary to correct or rewrite a letter this request is made on the slip. No marks are made on the letters themselves.

For training purposes we have two rooms which are devoted entirely to this work. One is a room for new typists and adjoining it is a room for the training of new dictators. Both these rooms are fitted with the necessary equipment and all equipment is brand new. The rooms are located right next to the office of the Correspondence Supervision Department, so that they are easy of access and the supervisors can keep in close touch with the new people. Because of this it is possible to get them into line more quickly, since everything that they do can be carefully watched.

An additional advantage is that it helps the new girl for she is not disturbed by being surrounded with a large number of new people or conditions which would be strange to her. Every kindness and consideration is shown her at the outset in an endeavor to immediately put her at her ease. This attitude toward its people is one of the foundation stones of the organization and it is fitting that it be manifested at this particular point.

The same is true in the case of the dictator. He can concentrate much better when left alone and in this way establish the good habits of dictation before going out into the department

THE MORAL ISSUES INVOLVED IN APPLIED PSYCHOLOGY.

By A. A. Roback

It seems rather curious that in the land where everything "*muss 'moralisch' sein*,"[1] as a great critic of Germany remarked over half a century ago, applied psychology should have been able to develop to the extent it did, without ever being put to the touch-stone of ethics, which has been applied in Germany to practically every department of human endeavor, including politics (Treitschke) and military affairs (von Bernhardi). In vain do we look for articles on the "*moralische Grundlagen*" or even on "*das Wesen*" of applied psychology. The most recent accretion to psychology seems to have been immune to such considerations.

The only writer, so far as I know, who saw the problem was Münsterberg, who had a wonderful knack for perceiving and defining issues, though it cannot be said that he always met them satisfactorily. Münsterberg's *Leitmotif* is the *subordination of means to ends*. This theme first appears in his *Psychology and the Teacher*[2] and is harped upon with slight variations in several of his later works. "No science of facts can show us any aims and purposes,"[3] is Münsterberg's dictum, and in the form in which it is put, one can scarcely dispute its truth.

We shall probably all recognize the force of the illustration appended, viz., that "the bridge builder, for instance, has learned his physics and thus knows all the laws needed to calculate the structure of a bridge, if the two banks of the river are to be connected at this spot. But no physical law can teach him that a bridge ought to be built over the river at this point."[4] The upshot of the discussion is that "economics, and not physics, decides as to the bridge; politics, and not geology, decides as to the tunnel, and ethics, not psychology, must decide the ends to which education has to lead the child. . . . ."

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[1] Ferdinand Lassalle, *Bastiat-Schulze von Delitzsch oder Kapital und Arbeit*. 1864, p. 90.

[2] The germ of the whole point of view may be found in his *Grundzüge der Psychologie*, especially Chapter V.

[3] H. Münsterberg, *Psychology and the Teacher*, p. 22.

[4] *Loc. cit.*, p. 23.

In another work the doctrine crystallizes and takes on a more pronounced shape. "Economic psychotechnics," Münsterberg tells us, "may serve certain ends of commerce and industry, but whether these ends are the best ones is not a care with which the psychologist has to be burdened. For instance, the end may be the selection of the most efficient laborers for particular industries. The psychologist may develop methods in his laboratory by which this purpose can be fulfilled. But if some mills prefer another goal,—for instance, to have not the most efficient, but the cheapest possible laborers,—entirely different means for the selection are necessary. The psychologist is, therefore, not entangled in the economic discussions of the day. . . . He is confined to the statement: If you wish this end, then you must proceed in this way; but it is left to you to express your preference among the ends."[5]

The proposed limitation of applied psychology is justified by Münsterberg on the ground that all causal sciences have to put up with the same renunciation;[6] hence whatever shortcoming this may be, it does not attach solely to psychology.

Thus the applied psychologist is freed from besetting obstacles and is given a clear path only after submitting to the conditions of the direction. The method is quite convenient and might easily be endorsed by the present writer if it were not contestable on other grounds.

The cardinal fault in Münsterberg's system is undue abstraction; and nowhere is this fact so patent as in his applied psychology. We must all admit that it is well for each man to know his place, and not to overstep the bounds of his authority; but we can not accept the picture of this world as a great hierarchical war department where all orders are executed by the subalterns without questioning. In life such a state of affairs does not exist. The world may be a stage and all the men and women players, but most people have more than one part to play. *Can we really divide the world* into applied psychologists, legislators, attorneys, social reformers, engineers, etc.? Is it not true that legislators are frequently attorneys, and may not applied psychologists be social reformers as well as scientists?

If the different departments of human endeavor were really to be subordinated to one another after Münsterberg's fashion, we should scarcely ever have any reforms; we should have to wait a geological age for the legislator *qua* legislator or the legalist *qua* legalist to change his conservative, if not reactionary, way of thinking. It is about this type of man that G. F. Arnold says: "Whether wilfully or unconsciously blind to the fact that it has no application, he obstinately pursues the only method which he knows or wishes to know, convinced that salvation lies here alone, and affects to have solved the problem, though in truth he has all along been dealing with fictions and has arrived at the most artificial of results."[7]

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[5] H. Münsterberg, *Psychology and Industrial Efficiency*, p. 19.

[6] *Cf.* his *Psychotechnik*, p. 40 and *Psychology General and Applied*, p. 351.

As a rule, the impetus that saves the situation comes from another quarter. It is the jurist who institutes innovations in the legal profession and not the legalist for whom precedent forms the only means of orientation. It is the social reformer rather than the legislator who is responsible for progress in legislation. Why, then, shall we deny the applied psychologist the right of bringing his observations, not merely his technical knowledge, to bear on the general situation?

Yet there is a certain plausibility in Münsterberg's analogy, which we must examine before proceeding any further. The fact cited is true enough. The engineer does not undertake to say whether the bridge *shall* be built. It is his business to set the actual building operations into motion; but it seems extremely doubtful whether any Public Works Department or economic commission would decide on the building of a bridge without first consulting engineering experts as to the prospects and possibilities. It will thus be seen that the coöperation of superior and subaltern antedates the actual decision about the end to be attained.

But the analogy has other important flaws that must be exposed in the interest of our subject, and that only go to prove once more the danger of employing analogies in science.

Suppose we grant that in state affairs a given project may be launched without, in the first place, consulting the person or persons to execute the plan; even so, we cannot apply the analogy to the case of applied psychology in general. The situation is different in more than one respect; and it is remarkable that these differences have remained unnoticed, while the view of Münsterberg,—the theoretician of applied psychology,—seems to have reassured the devotees of that branch in the belief that their path is free from moral scruples.

The bridge analogy in reality opens our eyes to the issues involved. When we ask ourselves: Why is it that the same illustration cannot hold of applied psychology, we discern three points of difference between the relation of the legislator and the engineer on the one hand, and the advertiser, let us say, and the applied psychologist on the other hand. They may be enumerated as the differences (a) between the *social* and the *individual* end; (b) between the *moral* and the merely practical or *expedient;* and (c) between the *objective as inorganic nature* and the *objective as human nature*. Those who do not fully grasp these distinctions will, of course, continue to see in applied psychology an instrument to be used without discretion at the behest of the first employer.

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[7] G. F. Arnold, *Psychology Applied to Legal Evidence.* 1913, p. 2.

The legislative act that calls for the building of a bridge is presumably a *social* measure. The employer, however, who is anxious to receive suggestions as to the best possible manner of turning out a cheap quality of goods certainly has an *individual* aim before him. Converting these aims into utilitarian terms, it may be said that the object of the legislative act is primarily the greatest happiness or well-being of the greatest number, while for the *entrepreneur,* the goal is his own greatest happiness, frequently at the expense of that of the greatest number.

This first distinction was already alluded to by the writer in a more specific connection. " Although the applied psychologist must leave it for others to state what is desirable, and to decide on the state of affairs to be brought about, he must constantly have the object of his task in mind; and for this reason he has a right to examine the purport of the end that he is pursuing. He must ask himself whether it serves the purpose of the idea for which his labor is to be undertaken. . . . . "[8]

The scope of this difference is more far-reaching and more ramified than one is led to suppose at first blush, for it involves a number of other fundamental questions, as we shall see later, anent the rôle of the applied psychologist in the sphere of human activity.

The second flaw in the bridge analogy is even more flagrant. It is a fallacy of the day, one that follows in the wake of material success. The *idée fixe* of the successful man is efficiency at the expense of everything else, or perhaps conversely rather, the goal of the efficient man is success at all costs. The line of reasoning in his case follows some such trend as this: " I am asked to advise X about such and such a matter. X knows his business well, and it is for *him* to decide whatever he wants. I am here merely to carry out his orders. The why and the wherefore are beside the point and do not concern me." In the *intellectual* sphere such an attitude would come under the rubric of the *lazy* argument, but in practical affairs, this mode of thought is quite active and effective. School readers and primers abound in stories calculated to cultivate just this habit of mind, *i. e.*, to inculcate in the child a spirit of obedience and love of discipline, but surely the applied psychologist must have a broader outlook on life. He ought to be able to distinguish between what is *desired* and what is *desirable*, between the professional and the moral issues.

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[8] A. A. Roback, Psychology of Confession. *University Magazine,* April 1917. XVI., p. 265.

The bridge analogy is more or less plausible,—and to a great many readers it will probably sound convincing,—because here we are moving in a professional realm. The engineer must bow to the authority of the legislator or the economist, because these are experts in their field, and it happens that their field takes precedence over his, though as has been stated, the precedence is only partial. The order and relationship of the various sciences demand a certain subordination of some scientists to others. Thus the psychologist, in a measure, looks up to the physiologist; the physiologist is somewhat dependent upon the results of the chemist and the physicist; and these, in their turn, court the mathematician with his positive formulae, but this professional subordination has no real bearing on our problem. In setting the actual building machinery into operation, the engineer is not beset by the question as to whether it is *moral* for him to undertake the task, unless, of course, he should happen to be approached by the enemy of his country to further their war plans, or a similar predicament should fall to his lot. Outside of these rare cases, his task is to determine merely whether a given project is *practicable*. It is different with the applied psychologist who has also to consider the *ethical implications of his task*.

The applied psychologist has a right to ask whether the object desired will serve the social as well as the individual end, for the very reason that in ethical questions, it is fatuous to talk of professional authority. In such matters, every man is his own expert, and, therefore, is not bound to take orders from his employer unless the latter's individual aim is, at least, not incompatible with the social end.

In a sense the same problem confronts every applied scientist; and we should be in a sorry state (at least in a sorrier state than we are at present) were the inventor, the chemist or the physicist to consider the immediate end of his task only. A suitable illustration may be had from a passage in one of Wilde's novels. We quote the impassioned appeal of Dorian Gray to his friend of former times, Alan Campbell, to destroy, by means of chemicals, the corpse of the artist that Dorian had foully murdered. In the following entreaty, it will be possible to detect, in a slight degree, the argument of the modern applied psychologist who wishes to keep the means and the end entirely apart from each other.

Says Dorian Gray:

"All I ask of you is to perform a certain scientific experiment. You go to hospitals and dead-houses, and the horrors that you do there don't affect you. If in some hideous dissecting-room or fetid laboratory you found this man lying on a leaden table with red gutters scooped out in it for the blood to flow through, you would simply look upon him as an admirable subject. You would not turn a hair. You would not believe that you were doing anything wrong. On the contrary, you would probably feel that you were benefiting the human race, or increasing the sum of knowledge in the world, or gratifying intellectual curiosity, or something of that kind. What I want you to do is merely what you have often done before." And when Campbell refuses to hear of the matter, Dorian's plea becomes more pointed. "No, don't think of that," he exclaims. "Look at the matter purely from a scientific point of view. You don't inquire where the dead things on which you experiment come from. Don't inquire now."[9]

It is scarcely necessary to go to fiction for illustrations. We have only to mention the idealism of the inventor of dynamite in founding the Nobel Institute, or the seeming inconsistency of Simon Lake, the inventor of the submarine, in publishing pacifist appeals in the form of large newspaper advertisements, while this country was on the verge of war with Germany. Inventors of the most infernal war-instruments will insist, with a certain amount of sincerity, that it was their purpose to benefit humanity by their inventions and not to contribute to its destruction. This apologetic attitude in itself is sufficient to indicate that means and ends are more or less inseparable.

It is only lately that such problems have been coming to the fore. Ethical issues have become so interwoven with the specific technological problems of the day that many of the accepted and time-honored practices of the professions are gradually falling into desuetude. We are beginning to gauge things more and more according to their *context* and less according to *tradition*. The situation as a whole, and not the individual practice, is now to be the governing factor. The office of the physician, since the days of Galen and Hippocrates, if not from time immemorial, has been invariably to cure, to prolong or to conduce to life. The twentieth century, however, has seen a more intimate connection between the medical profession and social reform movements, with the result that physicians are not guided now, as they were wont to, by that absolute maxim which seemed as inviolable as a law of nature. And though the action of the physician who chose to decide for himself the fate of the new-born cripple raised a storm of protests on all hands, the very act serves to prove that medical ethics is undergoing a great change. This is even more evident from the part physicians are playing in the birth control and similar movements, such as the sterilization of the unfit. The *right or logic* of such an alliance may be called into question, but our interest is primarily in the *fact* of such a *liaison*, showing us that the means can not be absolutely divorced from the end, as Münsterberg explicitly and other applied psychologists implicitly hold.

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[9] Oscar Wilde, *The Picture of Dorian Gray*, Chapter XV.

The applied psychologist, unlike other applied scientists, is in a somewhat peculiar position because he serves in the capacity of a go-between,—and here we come to the third point of difference between psychotechnics and other kinds of technology. The bridge that the civil engineer builds may shape the destiny of whole nations, yet it can not be said that his energy is directed, in the first instance, toward a human objective.[10] There is no interaction here between personality and personality as in the case of the applied psychologist, whose business it is to act as an intermediary between two parties, in fact, between two opposing sides. The civil engineer does not undertake to *influence anyone's mind*. His work is physical in the sense that any task can be called physical. A more subtle demand is made of the applied psychologist. He is looked upon as a medium between the salesman and the purchaser, between manufacturer and consumer, employer and employee, advertiser and reader. Theoretically speaking, his function is to bring about an understanding between the two parties concerned with the least expenditure of time and energy. In that case, we might regard him as a *mental broker* whose interest it is to serve both parties fairly. Every applied psychologist would probably agree, in theory, to this premise. Thus we repeatedly find in Münsterberg's later books the injunction that the applied psychologist must be impartial, that he must set about his task without prejudices, either economic or social. The injunction is a good one to have in mind, yet in practice it is far from being carried out. *In abstracto* the applied psychologist is in the service of humanity, in *reality* he is in the employ of the one who can pay and actually does pay for the advice and other, perhaps more practical, help he is receiving. Couch it in whatever terms we please, the applied psychologist is, under present conditions, an *agent,* not a broker. As an agent, he looks after the interests of the advertiser, the employer, the manufacturer, the salesman, etc. If this conclusion is denied, we have only to ask what applied psychology has to offer to the consumer, the employee, the purchaser, etc.

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[10] A. A. Roback, Psychology as Applied to the Natural Sciences. This *Journal*, 1917, I., pp. 145-146.

It does not require any subtlety to perceive this one-sidedness. The limitation attaching to applied psychology, though not inherent in it, has never been brought home so clearly to the present writer as on one occasion when, after delivering a talk on applied psychology to a mixed audience of radically-minded people, he was heckled by a moderately-educated Irishwoman who, in spite of her prolixity, succeeded in making her point. No one, at the time, felt more than the lecturer that his rejoinder was only a *tour de force,* that whatever benefits the workingman should reap by the efforts of psychology to perfect the industrial efficiency system, the advantage accruing to him would be only indirect, while the employer is gaining a net profit out of the psychologist's findings and management.

This phase of the story scarcely requires any amplification. Münsterberg's work in applied psychology has largely been indicted on this count; and it will be instructive to read how his *Psychologie und das Wirtschaftsleben* has fared at the hands of a German critic, who speaks in a derogatory manner of the *Amerikanistische Tendenz* which he finds in the book. In the detailed review by Willy Hellpach[11] of the German version of *Psychology and Industrial Efficiency,* the tone is somewhat more polemical than it might have been and betrays an irritated attitude on the part of the reviewer; but, making allowance for the vehemence of his criticism, it is not to be denied that Hellpach has put his finger on the weak spot when he says, in the course of his review: "Der Psychotechniker darf bald um die wirtschaftlichen Ziele sich kümmern, und bald hat er sie zu ignorieren. Er darf sich um sie kümmern, solange er sie billigt; solange er jenen Amerikanischen Optimismus sich bewahrt für den die wirtschaftliche Prosperität ein Selbstzweck ist, dem alle, aber auch alle anderen Rücksichten untergeordnet werden dürfen. Aber die wirtschaftlichen Ziele gehen den Psychotechniker in dem Augenblicke nichts mehr an, wo er beginnt sie zu missbilligen, an ihrere Güte zu zweifeln. Dann sinkt er in die Stelle des konsultierenden Psychologen engsten sinnes zurück; dann hat er die Probleme zu nehmen, die ihm gereicht werden, und ihre beste experimentale Lösung zu erwirken."[12]

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[11] Willy Hellpach, Hugo Münsterber, Psychologie und Wirtschaftsleben, usw. *Zeitschrift für angewandte Psychologie,* 1913-14. VIII., pp. 567-583.

Hellpach makes no effort to stop and consider the issues at stake. He contents himself rather with pointing out the contradictory phases of Münsterberg's various steps. In fact, in one place, he signifies his willingness to accept Münsterberg's position of subordinating applied psychology to the practical pursuits in life, provided the whole scheme works out consistently. We feel, however, that the problem is more fundamental than would appear from Hellpach's dialectic, and essentially formal, review. It is for this reason we have sought to approach the subject from an analytic angle. It is not so important to expose the contradiction as to discover its cause.

The weakness of the applied psychologist seems to be the weakness of every practitioner, and may be called the practitioner's bias,—a phenomenon most noticeable with the lawyer. It must, however, first be established whether the applied psychologist is to be considered as a mere practitioner. If we attach any value to Münsterberg's claim for applied psychology, then any department of psychotechnics is "*nicht weniger echte Wissenschaft als die theoretische Psychologie.*"[13] As a scientist, then, it is incumbent upon the applied psychologist to eliminate, as much as possible, personal motives and to serve the interests of humanity at large, rather than to align himself with one set of people against another. Yet in fairness to him, it must also be pointed out that there is more to be accomplished on the one side than on the other. It lies in the nature of things that the advertiser, the salesman or the employer is the *active* party, while the reader, the purchaser, the employee is *receptive*. The former have a *positive* business before them; the latter can only be taught how to protect themselves against the measures of the industrial and commercial officials. *Their* task can, therefore, only be a *negative* one; but even so, it need not be wholly neglected as it has been done hitherto, and, furthermore, it is desirable that discretion should be shown in catering to consulters.

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[12] *Loc. cit.*, p. 579.

[13] H. Münsterberg, *Psychotechnik*, p. 23.

If the applied psychologist never takes the trouble to inquire into the aim of his consulter, the situation would be unfortunate indeed. It is puerile to take up a legalistic attitude in such matters and to further every selfish and anti-social motive so long as the undertaking is within the bounds of the law. The psychologist knows that an advertisement with a sexual setting will enhance its force of appeal, yet such information, in the opinion of the writer, is not to be spread broadcast among advertisers, though not a few of them are their own psychologists in a practical way. There are no keener applied psychologists than the newspaper men in this country with their formidable headlines, amplified sensations, silly cartoons and infantile "funny pictures." If success counts, they must be congratulated on their achievement in stultifying the masses; yet what should we think of the applied psychologist who, on being asked how to increase the circulation of a newspaper, should put those means at the disposal of the questioner?

No connivance on the part of a consulting psychologist can be justified on the ground that applied psychology is an *instrumental science* and is, therefore, not concerned with ends. If we choose to accept this professional view, we shall be involved in no end of difficulties. As no purpose is ultimate, or absolute, there will be a tendency to rule out all ends and to ignore every consideration but what is expedient. The applied psychologist would then be reduced to the part of a Figaro, who manages to steer clear of all scruples, so long as he is compensated for his services. We should hope to see a brighter future for the applied psychologist than to be placed on the same level with the factotum barber of former times.

Applied Psychology in the Future

We have pointed out the chief limitation of present-day applied psychology. It would, however, be erroneous to suppose that the whole department is to be discarded because of this defect. As a matter of fact, the defect has arisen out of a misconception.

The conclusion has been reached that applied psychology has no voice in *defining and determining ends,*—which is a perfectly valid inference, considering the nature of applied science in general,—and forthwith it is assumed that applied psychology has no concern whatever in the purpose of the end to be attained. This transition from an obvious fact to an unproven assumption is manifestly unwarranted. We must surely realize that there is a difference between the *positive* operation of *determining an end* and the *negative* task of *checking it up*. Not only has the applied psychologist a right to examine the project that is laid before him, but he is in duty bound to do so.

Applied psychology is still in the stage prior to *mitosis*. When the division does take place, there will emerge two types of applied psychologists, each with a different function. The time is not yet ripe for a thorough organization and specialization of the whole field. It is inevitable that the two attitudes should conflict in that department for the reason that the territory has not yet been divided. It will not take long, however, before we shall see *an army of consulting psychologists* looking up towards the theoretical discussions of the *few general applied psychologists*, whose main office it will be to direct the profession along scientific and moral standards.

At the present time, we are in the process of building up an ethics of applied psychology. Naturally this line of work can not go on *pari passu* with the technological part proper, because we are dependent for the moral issues on the actual problems set us. The same is true of other branches of human endeavor. Legal ethics is a comparatively late development; and those who were responsible for its creation were not practising attorneys, but jurists who viewed the everyday cases in a philosophical light and treated them systematically as a connected whole. The practitioner precedes the jurist in practice, but the latter takes precedence over the former as to final authority.

The fact that there are such things as business ethics and legal ethics, in spite of the proverbial unscrupulousness of merchants and lawyers, should make us see what we have to expect of further developments in applied psychology. To be sure, there will always be a number of individuals who would not even attempt to rid themselves of the practitioner's bias. The total separation of means and end would impress them as the very course to follow, but as this field of psychology advances, there will always be enough theoreticians to expose that weakness and to demand a certain autonomy for the consulting psychologist.

Since applied psychology is still in its swaddling clothes, we need not be surprised at its being treated by means of analogies. The mistake of one of its nurses will not thwart its normal development.

In the social sciences, it is the *point of view as a whole* that undergoes a change rather than the particular theories and hypotheses. Much of Ricardo's economic theory, for instance, is still sound, but it is the new setting of the Austrian school that represents the great advance of political economy in recent years. Similarly the jurisprudence of the days of Austin and Maine is of a different texture from the brand elaborated by Jhering. The whole subject now presents an entirely different aspect with which the great British jurists could not have been familiar in their day. May we not predict a similar change of viewpoint in the case of applied psychology, in so far as it is a social science?

PRACTICAL APPLICATIONS OF PSYCHOLOGY IN THE TREATMENT OF CERTAIN PSYCHOPATHICS (AND OTHER NEUROPATHOLOGIES)[1]

By A. W. TRETTIEN, Toledo University, Ohio.

When your President did me the honor to invite me to address this body to-night, he suggested that the topic relating to Psychology and Psychopathics would be appropriate and acceptable. Your interests are essentially medical. Mine are psychological and educational. Hence my subject: Practical Applications of Psychology in the Treatment of Certain Psychopathics (and other Neuropathologies).

In discussing this essentially technical subject I shall treat it from the standpoint of a psychologist and set forth as clearly as I can the fundamental psychological principles involved, and let you make such medical deductions as you may.

Since coming to Toledo I have been interrogated regarding the phenomena of hypnotism, mesmerism, magnetism, spiritism, clairvoyancy, mind-cure, spiritualism, thought-transference. fortune telling, Christian Science, phrenology and a host of other allied interests. Now all of these are without doubt legitimate matters of psychological inquiry; but these inquiries suggest the index by which the psychologist may judge the present status of the popular notions of psychological speculation. To many persons who are otherwise very thoughtful and intelligent, psychology has not yet risen out of the vague fog of medieval mysticism. It is the business of the psychologist to analyze the phenomena involved, clear away the chaff of superstition and carefully garner the truth of the soul's experiences.

Psychology has passed from the mystical, purposive abstractions to a new day of the study of causal relations. The psychological laboratory has been established with its varied equipment, for the most subtle analysis and explanatory investigation of the mind's phenomena. With the laboratory there came the experimental method and technique. It began with the simplest experiments on sensations and impulses. The higher psychic states however seemed to defy the experimental method. But just as in the physical sciences the most complex phenomena have yielded to the experimental method, so the higher and more complex phases of the mind's experiences have been conquered one by one—memory, imagination, association, feeling, judgment, emotion, phobia and inhibition—all have become subjected to the scientific methods and are yielding rich fruits to science.

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[1] Read before the Toledo Academy of Medicine, Feb. 2, 1917.

But our modern age is a practical age, and psychology is responding to its needs. This new psychology, if it may thus be designated, is rich in its possibilities of application to our life's problems, wherever the human element is a factor. Hence we speak of the psychology of memory, attention, business, crime, pathology, fatigue, fine art, religion, etc.

The physician is a man of science. But he is more. He must also be able to apply the results of science to the prevention and relief of human ills. He has but one aim, namely —the health of the patient. To secure this end he summons the contributions of the various sciences—chemistry, biology, physiology, and physics for both diagnostic as well as therapeutic purposes. And now, what has psychology to offer for the relieving of human ills?

In the first place, modern psychology has established a new relationship between body and mind. As a matter of course, mind and body are interrelated wherever action is performed, whatever may be our philosophical theory. Physical changes are accompanied by psychical changes. " There is no neurosis without its accompanying psychosis " is a well established law. A disturbed liver produces melancholia. A wholesome metabolism produces an optimistic mind. An affected thyroid gland produces a disturbed mental state. On the other hand, the converse is true. "There is no psychosis without its accompanying neurosis." The whole muscular apparatus is set into motion by a mental state. A picture upon the screen may make the cheek blush or turn pale, which means that the large groups of blood vessels have become dilated or contracted due to the impulse from the vaso-motor nerve fibers. The action of the heart changes, the lacrimal glands overflow and fill the eye with tears. In a state of concentrated attention, which means, physiologically speaking, muscle tension, the posture of the body is changed, respiration, circulation, digestion and excretion are all more or less affected. The imagination may directly stimulate the secretions of both the ductless and the duct glands.

Experiments conducted upon rabbits and other animals show conclusively that fear and fright does have a direct influence upon physical growth and development. When the animals were kept in a constant fright it affected the functioning of the glands, changing the chemical processes of the body so as to prevent normal development. Observations upon school children go to show that fear of punishment, of examinations, of teacher or school-mates interferes with health. Laboratory experiments show that the slightest feeling may have its influence upon the pulse, respiration, digestion, glands and circulation. That thoughts give impulse to nerves that enervate the muscles.

In a word, any or all of these disturbances whether of physical or psychical origin produced changes of a physical or a chemical character that tend to disintegrate or reconstruct the tissues. Some of these changes are, in our present state of knowledge, irreparable. Some possibly may be restored by physical or chemical agencies like drugs or electricity; others may be affected by physiological or neural stimulations as in the case of osteopathy; still others by an appeal to the special sensory centers and muscular manipulation. The so called "cure" is effected in each by aiding nature's processes of metabolism. But there are other changes that may be stimulated by psychical impulses which affect directly the physiological functions as truly as a bath, an electric current or an opiate. In either case the effect upon the nerve cell is either to stimulate or to inhibit the functional processes of the organism. Modern observations and experiments in every field of psychology verify Seguin's law stated a half century ago, namely —to exercise an organism develops its function; to stimulate the function develops the structure of the organism.

Without doubt nine-tenths of the organic troubles of the race would be prevented or remedied if man responded intelligently to this simple law of hygienic living. In a simple statement the sensations, feelings, pain and pleasures and rational thought itself are the re-actions of the physical and psychical to warn, to invite, to lead the way to health and good fellowship in a world of constant flux. He who runs may read and take warning; or he must pay the doctor's bills. The ailments in which the average practicing physician applies his common sense psychology are too numerous to rehearse. Rapid progress is being made in our general educational campaign on health that is destined to make for human betterment.

The second rôle which psychology is playing today is that of a diagnostic function in certain neural disturbances. Modern psychology is a biological science; and as such the principles of a genetic psychology have developed contemporaneously with the theory of biological evolution and the unfolding of a comparative neurology. The tracings in the development of the nervous system parallel organic evolution from the lowest to the highest forms. In the simpler undifferentiated tissues of the lower forms of life there is a direct response to the stimulations from the world without; with higher organization of function and increasing differentiation the sympathic and the central nervous organization takes form up to man where the brain is *par excellence* the organ of co-ordinating functions. The psychical processes arise and become an integral factor in the reaction of groups of cells that function as ganglia.

This psychical element may either inhibit or re-enforce the original impulse. And all along the line of development every species of the race has left its contributions in ganglionic organizations in the struggle of life and death, in binding together those vital organs that may best sustain such groups of co-ordinating muscles as will succeed in doing the world's work. The work of Gall and Burdach in tracing these nerve tracts, of Forel and Nissl in showing the effect of severing nerve tracts, of Hughlings Jackson in formulating his three level theory of nerve functionings in the cord and brain, of Flechsig and Meynert in establishing the functions of different areas in the cerebral cortex; and later work by Kolliker, by Cajal and scores of others like Meyer, and Kraepelin has paved the way for the group of genetic psychologists like Hall, Jung, Freud and their schools, which are tracing the reactions of various ganglionic groups in the appearance of different psychical impulses, instincts, feelings, emotions, sensations and the higher forms of mental, emotional and volitional complexes as they appear in the process of mental evolution. And with the aid of the psychiatrist they are teaching the nature and causes of mental arrests as well as the processes of deterioration as they occur in the various forms of psychopathology and neuropathology. Practically all of this most remarkable chapter of science has been written by the generation of men now just closing their life work. How are we applying this rich fruitage to relieve human ills?

These studies have thrown considerable light upon etiology as based upon the genetic viewpoint. From them we get three quite distinct neuropathic periods. The period of infancy, to the age of three or four; the period of childhood, to the age of ten; and the adolescent period. Each period is fraught with dangers quite distinct from the others.

First, the period of infancy is subject to nervous disorders ı the form of convulsive seizures, paralyses, idiocy, imbecility, due so far as our present knowledge reveals to an unbalanced or defective development of the sympathetic nervous system, the cord and brain; the causes have been traced to predispositions, malnutrition, toxins, diseases and sudden nerve shocks that either exhaust the cells or produce an unbalanced condition between the motor and the inhibitory powers of the brain. If these maladies attack the fundamental or basal ganglia they usually interfere with the growth and development of the higher association centers that affect the intellectual and emotional life.

What can psychology do to cure these forms of neural disturbance? Directly, to the afflicted patient, it can accomplish nothing except through Seguin's law—by a stimulation of effort and function to structure. Little is yet being accomplished in profound attacks. Indirectly, in the matter of tracing causes and organizing an educational campaign of prevention, psychology is rendering important service. It can further assist in psychological diagnostics by placing responsibility for proper legislation for social and race betterment. Psychology can also suggest a course of training that may conserve and develop every power of the patient to the fullest and best of which it is capable.

During the second period, the period of childhood, the body is undergoing a series of changes that in a peculiar way tax the central nervous system and cause neuroses peculiar to this period. This is the age of second dentition, and digestive impairment is common. It is called the age of anemia. Dr. Hertel's studies go to show that in girls the percentage of sickness rises rapidly from the first to the third year of school life. He concludes that "we must put aside all illusions and confess that the present generation of young girls is weakly, anemic and nervous to an extraordinary degree." In the development of the nervous system the child is passing from the sensory to the motor period of life. The accessory motor centers of the brain are functioning more or less independently in accordance with the race tendencies;—hence many independent automatisms make their appearance. More than one hundred and twenty-five different forms of these have been counted. Most of these have to do with the face and hands because these centers are most highly developed; they may, however, involve the entire motor system.

These forms of neuroses among children are known in medical literature as chorea. Chorea is a functional disease which is characterized by irregular, involuntary twitchings of groups of muscles. These irregular choreaform twitchings are the outward signs of an unstable and incomplete cerebral development.

Psychology can assist in a proper diagnosis of these various forms of chorea, it can distinguish those forms which manifest a depleted vitality, requiring the rest and free play treatment, from those which are of functional incoördinations requiring training and direction through organized habits of application by bringing together the coördinations of the fundamental and accessory centers. These incoördinations are the *roots upon which all specialized motor training must* be *grafted.* During this motor period the effects of infantile cerebral paralysis become peculiarly apparent. The paralysis is the result of a cerebral lesion which cannot be removed by any therapeutic measures. Hope is expressed that good results may be obtained by orthopedic appliances and by tendon-transplantation. Psychology is just beginning to apply itself to the re-establishment of function through the process of re-education. This process rests upon the principle laid down by Seguin and gives much promise of good results.

The third period—adolescence—is the age that is peculiarly susceptible to the various forms of psycho- and neuro-pathologies. In consequence of the process of physical and chemical reconstruction the nervous system is put to the test in a peculiar way. New demands are made by the digestive organs; and these give rise to digestive disturbances which manifest themselves in distorted appetites, constipation, and flatulency. The heart, in order to meet these demands, may double its size, giving rise to cardiac disturbances of palpitation and nervous flutter; while the composition of the blood often produces a chlorotic condition. These changes tend to produce irritability, inertia and a nerve tension that causes in the adolescent an oversensitiveness of the psychic.

With the influx of new instincts and impulses wholly unknown to the youth before he becomes morbidly conscious of every physical process, he counts his pulse beats, and feels their irregularities, and as a consequence he develops a "cardophobia." With digestive disturbances there appear dermal eruptions, muddy complexions and various forms of skin disease. These also add to his already supersensitive nature. Adolescence is undoubtedly the age of incubation for many grave afflictions, "so that the germs of death are now taking root," as Dr. Hall says, "like tares among the forces of the budding, vernal life." Medical literature in the past has neglected the dangers of this most important period of human life.

An index of the demands made upon the nervous system may be seen in the nature and varieties of neural as well as psychical disturbances. From the extreme form of "ideoglassia," in which the person speaks in his own strange tongue, to the more common forms of stuttering we have illustrations of nerve incoördination. Before articulate speech is possible the higher cerebral centers must grip by the process of developmental coördination the sympathetics with the special ganglia and the brain centers that control the manifold musculatures of the speech centers—both sensory and motor—respiratory, laryngeal, glossal, facial; in fact the entire being, for the time being, functions in conscious speech control, and then reduce all again to the realms of the subconscious. Let any one of these centers play false and pandemonium reigns—in the form of psychical confusion and incoördination in which glands, organs and systems fully participate; and thought, feelings and emotions, muscle and neural deterioration, indigestion, chorea, and spasms may be the result. Psychology can analyze and stimulate through nature's batteries of the cerebral cortex those centers of muscle, thought and emotions that require stimulation and suppress those that require inhibition and thus restore the proper balance—controlled speech. These are functional impairments that no chemical or electrical stimulation will affect.

Epilepsy is a disease that has been discussed since ancient times,—both in medical literature and in Holy Writ. The term epilepsy generally suggests nerve spasms, violent seizures, idiocy and imbecility—a conflict between the deeper reflexes and the higher neural and psychical processes. An epileptic may belong to the lower strata of development; but there is also the ideopathic epileptic who may rise to the plane of a college graduate—these latter forms including the so-called reflex convulsions due to an unbalanced nerve functioning brought on by injuries, and by excesses of various kinds, drugs, opiates, great emotional disturbances and the like, which produce profound fatigue. Certain basal ganglia or reflex centers gain the ascendency over the cerebral processes. By means of suggestion and psychoanalysis psychology can inhibit, stimulate or reinforce the dormant centers and thus re-establish the normal reaction.

Hysteria may be described as a defect of will power and an excess of emotional excitation, including the hysterical mania in children or acute mania of the adolescent period; this disorder lends itself readily to psychological treatment. The nerve discharge may be re-directed into other channels; and the irritable, excitable, sleepless, crying, laughing, confused delirium may by this means be transformed into a calm, self-controlled, rational state. In this same group may be placed many of the phobias, which persist as emotional complexes and attacks. These appear in the post-adolescent years, especially in women; and they tend to make life a burden to the patient and his family. Many physical ills are caused by fear of darkness, of burglars, of cats, of growing old, of being unpopular, of unpleasant companions, of irksome work, of remaining single, of child birth, of inconstancy and by a countless thousand other fears which cause worry and insomnia, and which drain the cup of life to the dregs prematurely. Psychology can break up these emotional complexes, can remove the vestigial core, and can permit the psychic wound to heal, giving rise to a personality that is not rent in twain by conflicting motives.

These are but instances in the realms of everyday experience; others might be reported. From these it is apparent that consciousness is a potent factor in human history, and that applied psychology has an important service to perform in the evolution of the race.

Case 1. Young man, H. H., aged 21; voice did not change at the adolescence period; voice in high, nervous and uncontrolled pitch. His affliction was of great annoyance to him as he is a student in the university and has professional ambitions. The affliction is said to be due to a cold and a nervous throat trouble which occurred during the adolescent period; it has been diagnosed as "a congenital insufficiency of vocal cords," whatever that may mean. Chemical treatment by means of drugs, electrical stimulation, and mechanical manipulation were without effect. His was a functional disorder due to a psychical and neural cause. The vocal cords were examined and found to be normal in structure. The nerve tension was released, the conscious voluntary centers of the brain were incited to control the correct processes and submerged below the threshold of consciousness, and in this manner the normal function was established.

Many cases of speech disorders are of this nature of nerve incoördination—functional—and can be treated successfully only by proper psychological methods, either by suggestion or by psychoanalysis.

Case 2. A boy, B. C., thirteen years old; at school he was rebuked by his teacher; he refused to speak, became stubborn and for several months remained a silent member of the class. He was brought to the child clinic on October 5th, last. A physical examination revealed no abnormal conditions. His nerve reactions were normal and his motor control was good. All of the psychical processes,—perception, memory, imagination, association and judgment—were developing in a normal manner. His inhibitions were abnormally strong.

Several questions of a personal nature were put to him sharply when he turned pale. His hands began to tremble; his mouth became dry; his tongue clung to his palate; and he swallowed incessantly. His pulse increased, and he became mute. Employing suggestion and psychoanalysis we began a process of re-education extending over several weeks, with the result that the lad appeared before a section of the Northwestern Ohio Teachers' Association during the latter part of October and spoke to that body without embarrassment for several minutes. He is now quite master of himself.

This type of case is very common in all walks of life, especially among growing children where the process of functional development and nerve control is incomplete. Suggestion, control, and direction of attention in establishing definite habits of reaction will prevent these disorders; these measures may bring about a permanent cure if taken in time.

WHAT CAN THE PSYCHOLOGY OF INTERESTS, MOTIVES, AND CHARACTER CONTRIBUTE TO VOCATIONAL GUIDANCE?[1]

By JOSEPH K. FOLSOM.

In this paper I shall endeavor to discuss some by-products of recent psychological reflection and research in so far as they relate to vocational guidance. It is not expected that these will be of more than suggestive value. "What Can Psychology Contribute to Vocational Guidance?" would be a theme for a volume. It would include all the applications of mental tests of all kinds, tests of skill, etc., to vocational problems. But there is a field within the province of psychology which, compared with this field of intellectual tests, etc., has been given slight attention in a really scientific way, but which may prove to be as important if not more so than any other. This is the psychology of interests, motives, sentiments, emotions, will—what is often called the "character" side of mental life as distinguished from the "intellectual." It is not necessary to explain in detail the nature of this distinction—which is an important one even though we have given up the old idea of separate departments of "faculties" of mind. Roughly, for our purpose, the one field includes the various habits of manipulation (skill), language and other symbolic habits (intelligence), and of sensory impression, all of which habits are of significance not as individual habits, but through the *abilities* which result from them, which can be measured by tests. The other field, which is our present subject of discussion, includes the emotional reactions, among them satisfaction and annoyance, with their connections to various stimuli. What is of significance here is not so much measureable *abilities* resulting from them, but the *habits* themselves—that is, the strength of the various emotional reactions and the nature of the *stimuli* to which they have become attached.

This domain has been largely the prey of pseudo-science, and whoever enters it puts his activities therein in great danger of being colored by a suspicious and unscientific flavor. Nevertheless, although phrenologists have made character traits separate departments of mind, revealing themselves in "bumps" on the skull, although amateur psychologists of the business world compile long lists of character qualities without meaning or defined purpose, although pseudoscientific formulas for reading character on the basis of crude analogies and undemonstrated correlations are spread abroad and commercialized; still this is a legitimate field for really scientific consideration.

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[1] Paper submitted to Mr. Meyer Bloomfield in partial fulfillment of requirements of course in Vocational Guidance: Teachers' College, Columbia University, May 19, 1917.

(1) My first suggestion is that the objective or behavioristic view of human nature be taught to vocational scientists and that they be encouraged to think in these terms. By this I mean, practically speaking, that the fundamental terms or units in which human character must be conceived, are *stimulus* and *response,* and not ideas or sentiments or images or any bits of "mental content" or "mental stuff" or "data of consciousness." By this I do not mean that these subjective terms are not to be used at all, but that when used they are to be recognized for what they are, —i. e., simply names for various types of *relationship* which we observe or infer between stimuli and responses and the environment, and *not* as the ultimate data of a psychic world order distinct from the physical world. At present I cannot say specifically just how this difference of philosophical conception would make a difference in the practical efficiency of vocational guidance, but if clearer and more rational conceptions are ever agents of improvement, we need not doubt their value here. I can easily point out how the objective conceptions would seem very likely to facilitate other conceptions that would solve vocational problems more efficiently. The beneficial effects would be mainly indirect, but none the less important.

(2) Growing out of this is the problem of *character qualities.* The first impulse in attempts to tabulate human nature for vocational purposes is to make out a great list of qualities. Many employment systems demand that the individual be rated in dozens of these traits, listed like physical measurements. The trouble with this method as it is usually used is, first, that the conception of " qualities of character " is misleading. It is static and should be dynamic. A man does not " possess " so much honesty and justice and conscientiousness and leadership in the sense that he " possesses " a head and two arms or a 36-inch chest circumference, but these adjectives are to be thought of as naming characteristics of his *behavior* and its *stimuli.*

Second, these trait lists could be handled with more intelligence if they were properly distinguished according to the *kind* of relationship designated. Thus traits fall into two groups, (1) those that designate kinds of *behavior*, and (2) those that designate the *stimuli* to which many kinds of behavior are attached. Under (1) would come energy, kindness, aggressiveness, cheerfulness; while under (2) would come patriotism, loyalty, honor, justice, morality,—what are called "sentiments." If this distinction were borne in mind, traits would be more intelligently used and interpreted, with regard to their origin, permanence, and vocational significance.

A third trouble with these traits is that they fail to discriminate between different situations, and they assume too great generality. A man may be very aggressive in familiar situations, but timid in strange surroundings. Lack of concentration may be simply inability to cencentrate on certain kinds of work. The most cheerful individual in the office when things go right may be the ugliest when things go wrong.

To obviate this difficulty several methods might be used. One is to specify on these character blank forms all the more important and critical situations which come up in the occupational daily life and record the individual's reaction to each. Schematically, the question would be put: How does A, as compared with other individuals, react to the following situations?—Then follow a list of situations and stimuli such as: being alone, noise, being criticised by a superior, outdoors, close confinement, mechanical detail, dirt, dangerous tools, carelessness of inferiors, etc. Such a list could easily be devised to represent the most important situation-elements in any vocation or in vocations in general. Dean Schneider has well recognized this principle in his list of characteristics of men and jobs. Several of his traits, such as settled vs. roving, indoor vs. outdoor, directive vs. dependent, small scope vs. large scope, belong to this category, i. e., they refer to *stimuli* rather than to general qualities of behavior.

This matter is wonderfully clarified by the principle of the conditioned reflex, a concept developed in studies of animal behavior, and in terms of which the behaviorists would explain all human learning and the development of character. Briefly, it is this. If when a dog is fed a bell is always sounded within his hearing, after some repetitions the sound of the bell alone, without the food, will produce secretion of saliva, although previously it was a perfectly indifferent stimulus to the animal. The secretion is an original reflex act as provoked by the original stimulus of food tasting; but as produced by the bell it is an acquired or conditioned reflex, the bell being called the conditioned stimulus. The two stimuli have become associated through their being presented together many times. Now the same principle governs all our reactions, those that are called thinking and feeling as well as secreting saliva. A man may come to loathe indoor work because some past condition which produced illness was associated with indoor environment, not because of any general quality of "restlessness" or what not. A man may resent criticism so severely that his vocational efficiency is impaired, not from any general quality of independence or "know-it-all-ishness" but because of some childhood experiences. The effects of noise, fatigue and environment upon the worker, which also have been well discussed by Dean Schneider, and the general "energizing" effect, as he calls it, of various occupations, is partly a matter of these conditioned reflexes rather than of generic traits. It may well be remarked that all this does not teach a good practical observer of human nature anything that he doesn't know already, but I would answer that it will be apt to make him pay more attention to some of these things he knows, with resulting profit in analysis and judgment.

Another possible method of recording character would be to *specify* the *reactions* and inquire as to the stimuli. Thus, might be asked: In what situations is A cheerful, in what situations depressed, what stimuli make him angry, bashful, enthusiastic, indifferent, etc.? I have asked the question of 155 men, "What situations arouse in you the most anger or irritation?" and I found that the most numerously represented group of stimuli in the answers so far analyzed (73) consists of various forms of self-assertive and doimneering behavior of other persons, such as egotism, bullying, insults, ridicule, etc. It is possible that useful information of this kind might be gotten from self analysis supplemented by the observations of others that might be of real value in selecting jobs and job-holders.

A still better method would be to ask for a free and detailed description of the individual's habits, specifying the general respects in which analysis is desired, such as the general heads leadership, energy, adaptability, intellect, efficiency, etc., but leaving the particular stimuli and reactions both to be described by the individual himself or his judges (preferably both). In doing this the scheme of F. L. Wells (Psy. Rev. 21:295) might well be followed, adapting it to the particular purpose. In this way information more specific and hence more valuable would be secured than from any cut and dried list of items made up a priori. A useful variation of this method would be to ask, "List the respects in which A is superior to the average, and the respects in which he is inferior. What are his most noticeable characteristics?" Information of the kinds suggested here is commonly obtained in letters of recommendation, etc., and the method of getting it could be standardized. The best results are probably to be obtained by using a method which calls for some standardized judgments, and some free answers which give leeway to describe individual peculiarities that cannot be standardized. Many of the most important characteristics of individuals for vocational efficiency are such as cannot be described in one word or a few words, but must be described as certain well specified reactions to certain well specified stimuli.

That the stimuli cannot be too well specified is illustrated by the following personal case: One of the students in reply to my questionnaire stated that the "quiet regular life" was the foremost motive for his choice of vocation (teaching). This suggested that we might have here a fairly definite stimulus-element on the basis of which individuals could be classified for vocational purposes: those who like quiet regularity and those who like adventurous irregularity. Certainly this seems a fundamental distinction. To test its validity for persons, I made the nearest and easiest observation possible—on myself. A little introspection showed that both motives, the desire for quiet regularity and the desire for great excitement and irregularity, are equally strong in me and each has dominated some of my activities for a considerable period. I like a quiet regular life in the sense that I do not like uncertainties and I do not like a conflict of interests; that is, I like to do one thing at a time and do it well and above all not be compelled to think about anything else while I am doing it. On the other hand, I like an irregular adventurous life in the sense that in this work itself, or closely related to it, there must be great intensity and variety of stimulation—movement, continual progress, varied social contacts, travel, energetic activity physical and mental, new and unusual experiences. Thus it would seem that this desire for a quiet regular life may be one or both of at least two distinct and independent things: one the love of concentration and dislike of gambling, chance-taking, and uncertainty; the other, the ability to get along without great variety and intensity of stimulation. The experience of others might break up these elements into still smaller elements. Thus no doubt, most any of us enjoy some routine which we call "interesting," and dislike "uninteresting" routine. Sometimes I feel that the best way to describe any one's character is to say that "he likes what he does like and dislikes those things which he really does dislike." We hope, however, for improvement upon this.

(3) These considerations throw light on the value of photographs for selection of applicants. Experiments by Cogan and Hollingworth show that the correlations between character traits as judged by associates and the same trait as judged from photographs by any one judge selected at random is exceedingly low, although the correlation with the average of many judges of the pictures is better. It is barely possible, however, that the photograph might prove to be much more valuable than these figures show, because it seems often to indicate individual characteristics which cannot be described in terms of definable traits. As Hollingworth observes in his discussion of physiognomy, (Vocational Psychology p. 34) there are several ways in which facial features may be related to actual behavior. One of these is that facial lines may register emotional habits which have been formed. Another is that the reactions of other persons may tend to produce in an individual the traits which are expected of him by virtue of traditional associations with appearance. In selecting persons for occupations in which success depends upon ability to handle persons rather than things, certainly appearances have great influence irrespective of any behavior traits they are supposed to indicate. For such occupations the customary practice of judging from photographs certainly has this in its favor. Harrington Emerson has used this method to eliminate the greater number of applicants for positions, with satisfaction. It is impossible to say just what its value is.

(4) I shall summarize briefly some data concerning the motives of vocational choice. These were obtained from two questionnaire studies made by me, one upon 206 distinguished men of America (taken from Who's Who), and the other upon 155 upperclassmen of a small college (the entire two upper classes). The questions put to the students were: "What is your intended vocation? If not decided yet, what is the difficulty, and what possible lines of work are you considering? Please mention briefly, *in the order of their importance,* the chief motives for your choice. If your choice is not your real preference, what would you most like to do?" The eminent men were asked, among other vocational questions, "Chief motives influencing final choice."

The motives of vocational choice, as reported in the answers to the questions, seem very similarly distributed among these students and among these eminent men who were in college thirty years ago.

The following classification of these motives seems to come very naturally, and from both sets of data. They are designated as follows:

Int.—Interest, liking, or preference for the work for its own sake.
Adv.—Advantages accompanying the occupation but not intrinsic to it, such as outdoor life, independence, liking to be in command.
Amb.—Ambition, desire for influence, power, or success.
Soc.—Desire for social contacts of various kinds.
Ser.—Service to humanity or community.
Duty—A call, sense of duty, etc.
Fit.—Belief in one's fitness or experience for the work.
Opp.—Opportunity to enter the work or succeed in it, general or specific, "big field."
Fin.—Financial motive—money, profit.
Nec.—Necessity, usually for financial reasons.
Inf.—Influence of parents or friends.
Tra.—Tradition—" It was expected of me," " Always planned for it," a tradition in family.
Elim.—Elimination—This seemed the only thing left after giving reasons against other occupations.

I believe most all choices could be brought under these rubrics.

Since the number of cases for any specific occupation is small, the only very reliable results that I can get from my data are obtained by grouping the occupations under the few large heads shown below. This grouping is not a temporary whim or makeshift, but is related to one of the chief things I have been interested in studying, namely, the psychological differences between men of technical, impersonal interests, and those of relatively human, personal interests. With the students, agriculture is set by itself, as a somewhat special and significant vocation. It is one of the most popular of the technical courses at this college.

Each student gives from one to five of these several motives for his choice. In the table are given the frequencies of mention of these several motives for each occupational group and for the whole; the same for the eminent men. Each mention scores one point for that motive, with these exceptions: The first motive mentioned, if more than one are given, scores 2 points, and if it is the only one mentioned it scores 3 points. The answers of the eminent men were weighted in a somewhat similar manner.

The 13 motives were reduced by combining similar ones to 8 categories as given below in the table.

Percentages of various groups of motives of the total number (weighted) of motives mentioned by 155 students and 200 eminent men for their vocational choice		Total		Human occupations		Technical occupations		Eminent men (aesthetic)	Students (agricultural)	Actual total number of mentions (weighted) for students
		Em. men	Students	Em. men	Students	Em. men	Students			
Intrinsic interest	Int.	47.3	45.9	22.0	38.5	61.0	55.0	90.0	37.8	194
Satisfaction not intrinsic	Adv. and Amb. and Soc.	13.6	18.4	22.8	15.0	8.0	8.8	.....	44.5	78
Moral motives	Ser. and Duty	8.6	9.2	16.1	19.9	3.4	5.2	.....	1.1	39
Fitness	Fit.	2.1	7.1	2.0	7.9	1.3	6.1	5.0	2.2	30
Opportunity-field	Opp.	7.1	8.5	8.7	3.6	7.4	13.0	.....	6.7	36
Financial	Fin. and Nec.	8.2	5.4	10.7	9.3	6.7	2.6	5.0	5.6	23
Influence or tradition	Inf. and Tra.	5.6	4.3	6.0	2.9	5.4	6.7	.....	1.1	18
Elimination	Elim.	8.0	1.2	11.4	2.9	6.7	.....	.....	1.1	5
		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	423

STUDENTS—OCCUPATIONAL DISTRIBUTION

Vocations chosen	No.	%		No.	%
Ministry	11	7.1	Human	47	30.3
Law	7	4.5			
Teaching	13	8.4			
Business	13	8.4			
Journalism and advertising	2	1.2			
Other	1	0.6			

STUDENTS—OCCUPATIONAL DISTRIBUTION—*Continued*

Agricultural	28	18.0	Agricultural	28	18.0
Medicine	12	7.7			
Engineering, chemistry and other technical	49	31.6	Technical	61	39.4
Undecided	19	12.3	Undecided	19	12.3
	155	100.0		155	100.0

The eminent men who responded were classified as to occupation so as to agree with the above, as follows:

Human	Clergymen Professors of education Business—financiers Lawyers and judges Editors Actors School executives
Technical	Physicians Chemists Architects Electrical engineers
Aesthetic	Musicians Artists

The men questioned were arbitrarily selected to represent certain occupations typical of the human, technical, and other groups.

We cannot put too much faith in these figures but they are suggestive. A crude comparison between the students as a whole and the eminent men as a whole would hardly be just, because of the somewhat different vocational makeup and method of selection of the two groups, the slight difference in the questions asked and the manner of treating the answers, and the different viewpoint of a successful man of 50 from that of a student of 22. But if we note the differences common to technical and non-technical groups alike, we observe that the older men seemed more motivated by financial reasons and the method of elimination, and the students by service and belief in their fitness. This may be only a difference in viewpoint and frankness. On the whole, the agreement between the results of the eminent men and the students is very satisfying. That nearly half of the motivation for vocational choice among college men is sheer liking or interest for the work seems established. It is evident that this motive plays a much greater part in technical and scientific occupations. On the other hand, law, teaching and the ministry are more apt to be chosen for some less intrinsic satisfactions, such as social contacts, desire for leadership; and for service or for financial reasons. Even if the extrinsic satisfactions are added to the interest motives, on the theory that their distinction from the latter is merely due to the way occupations are conventionally thought of, the technical men still excel in motivation by liking and satisfaction.

With the agricultural students the distinction between liking for the work itself and for its accompanying advantages is especially hard to make, the latter including love of outdoors, of nature, "like to be near animals," health, etc. If we combine all these under interest, we find that the agricultural group is superior to all the others in this motivation, except the eminent artists and musicians, who proverbially are motivated almost entirely by liking for their work.

The superiority of the non-technical students over the older men of the same kind of occupations in interest motives seems to suggest that we are approaching an era in which the conception of these vocations will be changed—so that the ministry, teaching, law, etc., will be thought of more and more as scientific, expert occupations, into which men will enter because of sheer love of the work, and less from indirect motives.

Under the technical occupations, which here include medicine, civil, electrical and mechanical engineering, chemistry and ceramics; and also in the agricultural group to some extent, the students are influenced much by belief that "there's a good field for this kind of work." This belief is probably derived largely from hearsay. It illustrates one of the main points of service for vocational guidance. Another noticeable thing is the stock evaluation of the advantages of different occupations, such as the ministry for service, business for opportunities and success, and agriculture for health, outdoors and independence. Another point that ought to be investigated is parental imitation in choice. Although my cases are too few to establish anything, they suggest, and common experience suggests, that there is a greater tendency for son to follow father in the medical profession than in any other profession.

(5) The psychology of interests and motives reveals two seemingly opposite principles. One is the permanence of interests, as shown by a statistical study by Professor Thorndike (Pop. Sci. Mo., 1912, Nov. Also in "Readings in Vocational Guidance"), and Kent's "Constructive Interests of Children." The other is the principle that the same general interest may be satisfied equally well by a great variety of

possible vocations. Any one vocation, such as that of the business executive, furnishes elements that would satisfy men of a wide variety of desires and motives. Unless the individual possesses certain habits of feeling, i. e., conditioned-reflexes, that limit greatly his sphere of possible satisfaction, both he and the job are exceeding flexible.

(6) We have seen that motives and sentiments are very real things and worth studying, but they are exceedingly illusory, inconsistent and misleading. Our emotions and sentiments are safe guides only in so far as they are anchored to the rock of *knowledge*. It is intelligence that clarifies. Half of the traditional notions about the satisfactions and advantages of various occupations, and the various sentimental attitudes toward them, melt like mist in the light of accurate information. The function of vocational guidance has been sadly misconceived. Reasoning from analogy with the "natural sciences" and arts like chemistry and engineering, it is supposed likewise that vocational science puts in the hands of experts knowledge by which they can direct and control the material in their hands, i. e., fit men to jobs on the basis of their abilities and interests. But the function of the mental and social sciences, including vocational guidance, must in the nature of things be different. It can not be centralized control, but rather the dissemination of knowledge and illuminating ideas by which all persons will be enabled to guide their *own* lives more intelligently. We cannot choose a vocation for any individual, but we can place before him such information that many mistakes commonly made would be practically impossible.

This educational function of vocational guidance naturally consists of two parts. The one, which has been well discussed in the literature, is the field of information about occupations, their requirements, opportunities, distribution, rewards, etc. This, which is certainly the most essential field, might be called occupational sociology. The other field, to which slight attention has been given so far, is knowledge of *human nature*. It is to this that I would call attention, as my final suggestion. I believe that a complete program of vocational guidance in a school system, especially in the colleges and high schools, should include some kind of a course of study of the science of human nature; the purpose being to teach the youth a more intelligent understanding of himself and of other persons. In other words, I would advocate the study of elementary psychology and social psychology at least as far down as the high schools, and reading courses in the same for employed, continuation school students, etc. Not that the name psychology is essential, nor that the subject would be taught in anything like the traditional text-book way.

Such a course should include the following topics: The nature of stimuli and reactions, the formation of habits, the principle of the conditioned reflex (call it what you will), the most effective modes of learning, the nature of sentiments and interests, the nature and conditions of ability, the concepts of continuous variation and individual differences; and above all, the psychology of custom, convention, tradition, and fashion. The last I would interpret in the light of Trotter's "herd-instinct"—the concept of man as a gregarious animal and hence fundamentally irrational in his beliefs and activities, including his vocational sentiments and adaptation to vocational life, which unreason can be corrected only by patient study and open-mindedness. These concepts properly interpreted and adapted to age and past education would, I believe, be no more difficult, and far more interesting, than much of the traditional subject-matter students are now compelled to absorb. A good deal of material of this kind is presented now in the English course, including composition, public speaking, literature, courses in business forms, courtesy, etc. This is valuable; the possibilities of its development are illustrated by Davis' book on "Vocational and Moral Guidance." In general, however, I do not think the English course is adequate for what I suggest. For one thing, the English teacher teaches a subjective psychology, whereas I believe the objective psychology of stimuli and behavior is the thing needed. Secondly, the English course makes *language* too much of an *end* in itself—places the established forms on a sacred pedestal—instead of viewing them as mere tools for efficient communication and thinking. Third, the English course as usually taught is colored by too great a reverence for the past and not enough for progress and efficiency.

Such a course of study would, I believe, materially aid the youth to understand his own attitudes and sentiments toward vocations, the mass of traditions and conventions to which he must adapt, and the peculiarities of his fellow men whom he must obey, command, or co-operate with, in vocational life. The aim would be not a morbid introspection of self and motives, but an intelligent, objective understanding of self that would do away with this very morbidness of which introspection is accused.

THE CURVE OF WORK AND THE CURVE OF SATISFYINGNESS

By Edward L. Thorndike, Teachers College, Columbia University

Twenty-nine adults worked at grading printed compositions for approximately two hours on each of two days as continuously as they could. The speed of the work was scored by the time required for each ten compositions; the quality of the work was scored by the average deviation (regardless of signs) of their grades from the average judgment of twenty or more competent graders; the satisfyingness or tolerability or zest or interest of the work was scored from 0 to 10 at the end of each approximate twenty minutes, 0 meaning the greatest discomfort or distaste or aversion the subject had ever experienced for mental work in his life; 5, his average enjoyment of mental work during the year or so past; and 10, the greatest interest, zeal or satisfaction he had ever experienced in mental work or play. 1, 2, 3, 4, 5, 6, 7, 8 and 9 were to mean equal intervals from the 0 to 5 and from the 5 to 10. A half-hour of fore-exercise was taken to familiarize the subject with the method of grading.

The general result is that the quantity and quality of the product produced per unit of time both remain substantially the same during the two-hour period, but that the satisfyingness as reported decreases greatly. It decreases rather steadily from beginning to end. The facts are as follows:

Dividing each individual's work during the two-hour period into three approximately equal successive parts, the average errors per composition in successive sixths stand in the proportions:

100   103.8=1.7   101.6 ± 1.7

The average times required to read and grade the compositions in successive thirds stand in the proportions:

100   97.3 ± 1.0   100.6 ± 1.0

The average degrees of satisfyingness in successive sixths were:

4.4   4.0   3.6   3.4   2.8   2.6

These facts concerning satisfyingness are repeated in Fig. 1.

The curve of work done (in the sense of the quantity and quality of product produced per unit of time) is thus approximately a line of zero slope, but the curve of satisfyingness of the process of producing it shows a sharp descent. I present (in Fig. 2) curves separately for those whose satisfyingness in the first twenty minutes was from 3 to 4, those beginning at from 4 to 5, and those beginning at 5 to 6.0. Two individuals who began with a satisfyingness of 1 and 2 respectively found the work equally intolerable throughout.

These facts support the general doctrine that the effect of lack of rests is far greater upon whatever is the physiological basis of interest, willingness, or tolerability, than upon the physiological basis of quantity and quality of product produced. Or, in other words, the mechanisms determining the mind's achievement are left able to do their customary work, but in such a condition that their customary action is less satisfying, so that (except for extrinsic motives) the individual would relax, intermit or abandon the action in question.

Five individuals performed an experiment the same as that described above, save that they worked for four hours continuously, instead of for two two-hour periods. The results from their records confirm the results already given. The average errors in successive sixths of the five hours were in the proportions:

100 99 98½ 98 92 92

The average time required to read and grade the compositions were in successive sixths in the proportions:

100 95 93 95 94 97

The average scores for satisfyingness were for successive twelfths of the four hours:

6.0, 5.7, 5.2, 5.0, 4.6, 4.3, 3.6, 3.3, 2.8, 2.4, 2.5, 2.2

The curve for satisfyingness is thus as shown in Fig. 3.

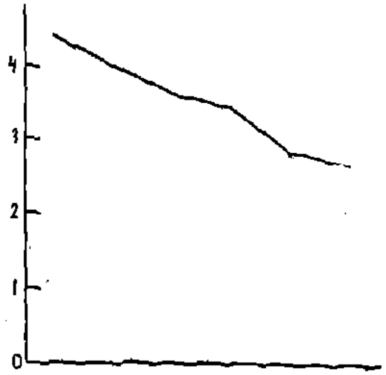

Fig. 1. General Average Curve of Satisfyingness During Two Hours.

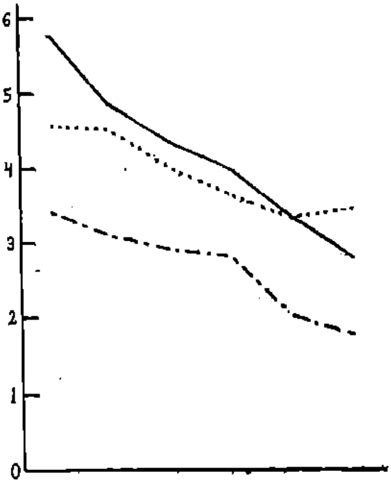

Fig. 2. Average Curves of Satisfyingness of Three Groups Differing in Initial Satisfyingness.

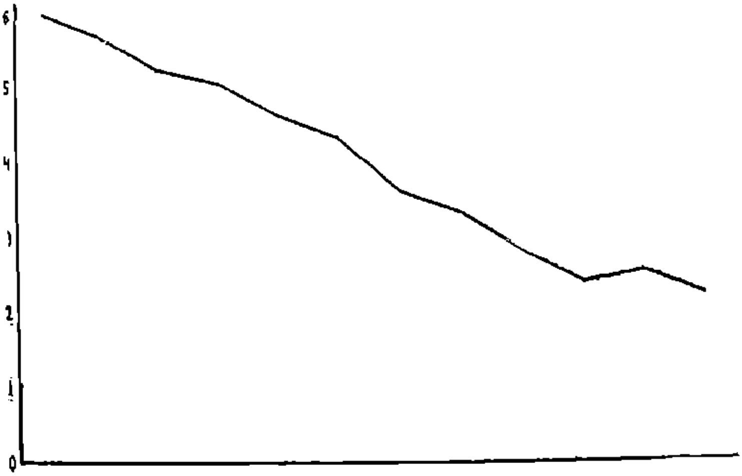

Fig. 3. Average Curve of Satisfyingness During Four Hours.

PSYCHOLOGICAL TESTS FOR STENOGRAPHERS AND TYPEWRITERS

By HERBERT W. ROGERS, Columbia University.

1. Statement of the problem.

The present study represents an attempt to actually test out in practice the method of "empirical vocational tests" and to discover, if possible, tests for specific commercial functions which may have practical significance. To quote Hollingworth's account of this method: "If the test records and ability of any particular type of work show a high positive correlation so that an individual who is good, medium, or poor in the one is, as a mere matter of fact, also found to be good, medium, or poor in the other, then, without further analysis, the one may be used as the sign of the other."

The type of work selected for correlation with the tests in this experiment was the work included under the term "stenographic ability." The three external factors in stenographic ability seem to be a knowledge of (a) stenography, (b) typewriting, (c) grammar, spelling, punctuation, etc.

2. Material employed.

Ten tests which measure the speed of mental functions or processes were used in the experiment. Nine of these tests were taken from the group of tests standardized for the American Psychological Association by Woodworth and Wells. The tenth test was one of the Trabue language tests. Five of these tests were those commonly called the logical relations tests, opposites, verb-object, agent-action, action-agent and mixed relations. Under the head of "the understanding of directions" the hard directions test was used. From the cancellation tests the number checking test was selected, a group being checked whenever it contained the two numbers 8 and 9 in any combination. Under the formation of new associations the form substitution test was used. The color naming test was also used.

3. Conduct of the experiment.

(a) Individuals serving as subjects.

Eighty-seven young men and women who were students of either or both typewriting and stenography in the Extension Department of Columbia University served as subjects. These people were divided among five different sections—four evening classes and one day class. In all of the evening classes it was impossible to obtain any adequate knowledge of the subjects' abilities, for they either dropped out in a short time or failed to take the prescribed tests and examinations.

The results worked up in this experiment are based upon the day group of forty-five subjects—forty-three women and two men. These people made a rather intensive study of both typewriting and stenography devoting two hours, in class, to each subject for five days a week. Some outside study was also done.

In the group there was represented a very high type of native ability for the stenographic profession as will be seen by the following table:

EDUCATION

.02 had a common grammar school education.
.02 attended high school for one year.
.51 had a full high school education.
.11 attended college for one year.
.09 attended college for two years.
.22 were college graduates.

AGE

.46 were from 16 to 19 years old, inclusive.
.29 were from 20 to 24 years old, inclusive.
.06 were from 25 to 29 years old, inclusive.
.11 were from 30 to 34 years old, inclusive.
.04 were from 35 to 38 years old inclusive.

(b) General procedure.

The Trabue, number checking and form substitution tests were given by the group method. The remainder of the tests were given individually. The method of conducting the experiment was very simple. The subject was seated comfortably at a table, on which the test blanks were shown, one at a time, after it had been ascertained that the subjects understood the instructions. In the Trabue, number checking, form substitution, and hard directions tests the replies were filled in with pencil. In the remainder of the tests the replies were spoken. In the tests where the replies were read aloud the experimenter, who sat next to the subject, had a sample of each test and if an inaccurate reply was made the subject was required to correct it before proceeding to the next word. All the tests were made between the hours of 12:30 and 3 p. m., in the month of November, 1915.

(c) Instructions to the subject.

In the instructions to the subject an attempt was made to combine the proper comprehension of the experiment by the subject with an ideal uniformity of instruction. In the individual tests instruction was given by description, illustration and execution. The subject was first clearly told the meaning of the test; then the operator performed a small sample of it, and finally the subject himself performed a small sample of the work. These samples were typewritten and the same trial sheet was used with all the subjects. From four to six illustrations of each test were used. In the class tests the subjects were simply told what they were to do and the operator performed a sample of the work on the blackboard.

An attempt was made to impress upon the subjects the fact that speed was the main object of the tests. They were told that their mental reactions were being timed and that their individual results were going to be compared with the rest of the class. They were requested to go as fast as possible but were warned that they would have to correct their mistakes. It seemed that the great majority of the subjects tried to make all the speed possible.

(d) Records.

In the individual tests the time was taken by a split second watch reading to fifths of a second, the watch being started when the subject's eyes met the first work on the paper, which was uncovered by the experimenter.

Class tests. *In the number checking and form substitution* tests instructions were given out, before the test was begun, that as soon as anyone finished she was to raise her hand. When the first hand was raised the experimenter called upon the class to stop (having instructed them before that he would do this). Thus the time for all was the same and the experiments were worked up for the amount done. In the Trabue test the subjects were given ten minutes to finish and those who finished before this time had a note made on their paper of the time.

4. Method of working up the results.

(a) Treatment of errors.

Errors in the hard directions, form substitution, and number checking tests have been disregarded. The basis of getting measures was simply the time in the hard directions test and the amount done in the form substitution and number checking tests. In the Trabue test, as given, there are three inconstant factors, namely, the amount done, time, and errors. No attempt has yet been made to score and correlate this test.

(b) Methods of combining the individual measures.

When several tests have been made of an individual's abilities it is often desirable to show the success of each individual in the series of tests taken as a whole. A good way of doing this is the order of merit method. The measures of an individual are arranged so that we can state that an individual stood 13th in one test, 23rd in another test, 18th in still another test and that his average rank was 18th.

Although this is a rather rough method, it has worked out well with some sorts of material. But to transmute absolute quantitative measures into an order of merit is to throw away a great deal of information contained in the measures. There is another method which preserves all the refinement of the original measures which has been proposed by Woodworth. The average of the group in each test was counted as zero, and the individual's standing was expressed by a deviation above or below this average; the measure of variability (mean square deviation) was taken as the unit deviation, all deviations being expressed in multiples of this unit. What this method does is to assign each individual's position in the distribution of the group. This method was used in getting reduced measures in the tests which were to be correlated with ability in typewriting.

(c) Methods of correlation.

The order of merit method was used in correlating the tests with ability in stenography and grammar. The rank differences formula was used, $r=1-\frac{6\Sigma d^2}{n(n^2-1)}$

The formula used for correlating the tests with ability in typewriting was a derivation of the Pearson formula, $r=2\text{Av.}\left(\frac{a+b}{2}\right)^2-1$, a and b being the reduced measures in the test and typewriting.

In getting the team correlations in typewriting the combined reduced measures were corrected by dividing through by the square root of the average of the squares of the reduced measures.

(d) Methods of obtaining measures of stenographic ability.

In stenography the instructor's mid-year grades were transformed by him from the vague statements of A. B. C. D. F. into a strict order of merit series from one to forty-five.

In grammar the subjects were examined in spelling, grammar, punctuation, letter writing, paragraphing, etc. Their grades, which were returned in per cents, were readily transformed into an order of merit series.

In typewriting more objective and reliable grades were obtainable since the young women were given a typewriting exercise each month. The subjects wrote on the typewriter for ten minutes from dictation. The total number of words written was added up, five words were deducted for each error; this sum was then divided by ten and the result expressed the net number of words written per minute. These objective grades are free from the error of an instructor's judgment. Correlations were made every month between the mental test given in November and the monthly grade in typewriting.

5. Results.

A. Correlations.

	Opposites	Verb-object	Agent-action	Action-agent	Color naming	Mixed relations	Directions	Number checking	Form subs.	Subjects
Stenography	.45	.36	.19	.23	.34	.31	.46	.07	.40	45
Grammar	.40	.37	.37	.35	.38	.43	.54	.22	.16	45
Typewriting:										
October	.17	.41	.29	.42	.30	–.09	.11	.45	.21	42
November	.11	.43	.19	.43	.43	.21	.14	.47	.27	40
December	.07	.46	.40	.29	.45	.17	.19	.37	.11	40
February	.15	.55	.31	.41	.41	.25	.13	.53	.37	40
March	.19	.21	–.02	.00	.29	.04	.34	–.01	.30	29
April	.54	.57	.28	.40	.61	.00	.32	.30	.42	27
Average	20.5	43.8	24.8	32.0	41.0	13.0	21.0	35.0	28.0	36.0

B. Team correlations.

Stenography	
1. Opposites, verb-object, color, mixed relations, directions, form	.40
2. Opposites, verb-object, agent-action, action-agent, color, mixed relations, directions, number, form	.48
3. Opposites, directions	.51
4. Opposites, verb-object, color, mixed relations, directions	.53
5. Opposites, verb-object, directions, form	.61
6. Opposites, directions, form	.63
Grammar	
1. All tests	.53
2. Opposites, verb-object, agent-action, action-agent, color, mixed relations, directions	.57
3. Opposites, mixed relations, directions	.56

Typewriting	
1. Verb-object, action-agent, number	.56
2. Verb-object, agent-action, action-agent, color, number	.56
3. Verb-object, action-agent, color, number	.58
4. Verb-object, agent-action, action-agent, color, number, form	.62
5. Verb-object, color, number	.63

(c) Discussion of correlations.

In considering the first four months' correlations in typewriting one is met by the very striking fact of the uniformity of the results for all the months in any one test. If a test is high one month it can be predicted that it will be high another month; if the test is low one month it can be predicted that it will be low another month. In other words we can give the subject a typewriting test at any time and the correlation will always be practically uniform.

The March correlations show no corespondence with the correlations of the other months. The March typewriting test was an especially difficult one. This means that it called for reactions which the subjects had not been in the habit of making—it called for the functioning of processes which did not exist or which were not well developed. Thus, since the exercise was exceptional, it might be expected that the results and therefore the correlations would be exceptional and the uniformity of correlation would be absent. It must also be taken into consideration that there were only twenty-nine subjects instead of forty as usual.

The April correlations show a good degree of correspondence with the first four months, except for the opposites and number checking tests. But here again it will be noted that only twenty-seven subjects took the exercise. The reduction in the number of people taking the tests does not show a process of an elimination of the unfit, for some of the best pupils were in some of the university offices doing work in typewriting.

It is interesting to note that none of the tests, which when combined into teams give the best correlations with stenography and grammar are used for giving the best team correlation with typewriting.

It is also an interesting fact that the two tests which are distinctly not language tests—number checking and form substitution—do not correlate well (except in one instance) with stenography and grammar, but that one correlates very well and the other fairly well with typewriting.

(d) Correlation and practice.

The following table will show that practice tends to increase the correlations, as has been pointed out by Hollingworth. Only the first four months' correlations are used on account of the distracting factors operating in the fifth and sixth months. Table 1 gives the average correlations of the tests which have a high positive correlation with typewriting. Table 2 gives the correlations of all the tests:

	1 Tests Verb-object Color Form Average	2 Tests All Average
October	.387	.253
November	.443	.293
December	.427	.266
February	.493	.345

6. General Summary.

It is evident from the foregoing data that this method of "empirical vocational tests" gives a far more reliable criterion for vocational guidance in the field of stenography than has ever been attained by any other method.

From the results obtained in this experiment on forty-five subjects it does not appear to be too optimistic to the writer to say that under more favorable conditions a series of tests could be found which would give a much higher correlation than we have found here and which would yield a better criterion for a system of vocational guidance and selection in the stenographic profession. If a much larger group of subjects were worked with the correlations would probably be raised and would then be more reliable. If more tests were given there would undoubtedly be more tests found to have a high positive correlation with the work, and the correlations would be raised when they were teamed. Furthermore, the conditions of conducting the experiment could be improved. In short there were many factors which tended to lower the correlations which could be, in part, eliminated.

From the foregoing facts it is evident that these miscellaneous tests are of practical significance. It is also evident that the method of "empirical vocational tests" does actually work out in practice.

ASSOCIATION-REACTIONS APPLIED TO IDEAS OF COMMERCIAL BRANDS OF FAMILIAR ARTICLES[1]

By L. R. Geissler

I. *Introduction*

The scientific study of the psychological aspects of marketing began with the investigation of the mental factors involved in the commercial efforts of appeal through advertising. The center of the problem was the mind of the prospective customer, and the question to which psychology first applied itself was: how may a person be persuaded most effectively through advertising to purchase a certain commercial brand of article? The immediate success of the early work was the more striking because it introduced scientific principles where before only haphazard and unsystematic efforts based on costly experiences had prevailed. It was not difficult to point out the various psychological principles that were violated even by the best advertisements of that time and to convince the most progressive business-men that adherence to these principles would result in financial gains.

Nevertheless the deeper problems which require a closer scrutiny and finer analysis of the mind of prospective customers have hardly been touched, and yet the interest in this phase of applied psychology seems to have very much subsided and given way to the problems of salesmanship. The main question now under investigation is: How may a person most effectively persuade others to buy a certain brand of article? This shift of emphasis from customer to sales-clerk in the psychology of marketing is significant in several respects. In the first place, it does not promise such spectacular results by simple methods as the early work did, but requires instead much patient, persistent and well planned work. In the second place, it will thereby teach a most wholesome and much needed lesson of being contented with slow and small progress instead of looking for immediate and large returns. And finally, it will lead to the establishment of much more refined and subtle methods of research in the various fields of business psychology. Thus it may ultimately lead to a revision of the early pioneer work in the psychology of advertising, especially if the latter has not in the meantime regained some of its original interest and impetus. In particular it will become necessary to realize that a study of the mind of prospective customers must be approached from a broader standpoint than that of the advertisement only. The advertisement is only one, and perhaps a comparatively insignificant item in the mental life of the layman whose needs and desires are determined by complex situations to which he has to adjust himself, and not simply by a series of advertisements to which some business concern wants him to react favorably. There seems to be a tendency to overlook the other factors which influence a person to purchase articles of certain brands; and therefore it seems appropriate to determine how strong an influence the advertisements exert in a person's daily life, as compared with other factors, and to attempt to list some of the more important of these influences.

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[1] The writer is indebted for co-operation in gathering data to Professors R. S. Woodworth of Columbia University, Max Meyer of the University of Missouri, Herbert Woodrow of the University of Minnesota, C. S. Yoakum of the University of Texas, and L. L. Thurston of Carnegie Institute of Technology, Pittsburgh; and to his wife for much patient and conscientious aid in classifying and computing the statistical material.

The present study was thus undertaken to gain, at least in a preliminary way, such a more general insight into the mind of a person who may be contemplating the purchase of a given article. In particular, we attempted to determine which brands of certain articles are thought of first, most frequently, and why? For this purpose the following experiment was devised. We prepared a list of the names of twenty articles which men are apt to buy for themselves in the retail trade, as follows: baseball, camera, candy, clothes, collar, soft drinks fountain-pen, garter, hat, popular magazine, notepaper, penknife, shaving tool, shirt, shoes, soap, summer-underwear, tobacco, tooth-paste, and watch. This list was submitted to groups of men who had been provided with prepared blanks of paper on which appeared a narrow vertical column, headed "Brand" and a wide one, headed "Reason." The experimenter read to each group the following set of instructions:

"After a warning signal I shall pronounce the name of an article which men are apt to buy for themselves in the retail trade, such as: handkerchief, ink, scarf-pin, etc. Let the word call up in your mind a particular commercial brand or trade-name of the object; for example: "ink" may call up "Carter's," or the like. Write immediately the first name which thus occurs to you in the column headed "Brand." In the remaining space of that same line (headed "Reason") indicate as far as you can and in as few words as possible what you believe to be the main reason why the particular brand occurred or came first to your mind. If there are several such reasons, write them in the order in which you think of them, but do not use more than one line for each article and its reason. If, however, no brand occurs to you within the time allowed, or if no good reason can be found for a certain brand, make a dash in the proper place and wait for the next word. There will be twenty articles; one minute is allowed for each.

Let me now give a concrete illustration of the whole procedure: I may say, for example, "Number seven — ready — rain-coat," and some one may write, for example, "Goodyear — I possess one," or another reason "saw a street-car poster of it," or the like. Keep in mind that "brands" or "trade-names" are not the same thing as names of local stores or of retail dealers."

After assuring himself that all subjects had correctly understood these instructions, the experimenter proceeded with the words of the list. This experiment was carried on in the following states: Georgia, Illinois, Massachusetts, Minnesota, Missouri, New York, Pennsylvania, and Texas. While the number of young college men tested in each state varied greatly, we obtained results from 300 subjects giving a total of 6,000 data, and on the whole these data are very uniform. The slight differences due to peculiarities of localities will be pointed out later, after we have discussed our results from the points of view of the brands, of the reasons for their occurrence, and of the classes of articles.

II. *General Psychological Factors*

In considering our data with reference to the commercial brands mentioned, we must remember that our subjects were instructed to write down the *first* brand which occurred to them after hearing the name of a given article. If there are no special factors entering into the situation which favor for the time being the recall of one particular brand, we are justified in assuming that those brands will first occur to mind which in the past experiences of the individual have formed the strongest associations with the respective articles. This assumption is borne out by a repetition of the experiment after several months' interval with four of our subjects. They thought of the same brands which they had previously mentioned with the following six articles: baseball, camera, collar, drink, garter, and hat. The brands of magazine, notepaper, shoes, and soap had been changed by two subjects each, while the brands of the remaining ten objects had been changed by only one subject each. In other words, of the eighty possible changes in brand only eighteen had occurred, while in the other sixty-two cases (77.5 per cent.) the same brands were mentioned in both tests. This number therefore indicates the strength and permanence of the associative bonds between certain articles and their respective commercial brands.

The question why in any given individual the idea of a certain article has formed a stronger bond with the idea of one commercial brand rather than with that of another, is entirely a matter of a person's past experiences. The factors which determine the formation of such bonds are included in the psychological laws of the association of ideas,—similarity, contrast, contiguity in space, temporal simultaneity and succession, frequency, recency, primacy and vividness of experience, and emotional congruity. For the sake of clearness of exposition we may call the strongest association between the idea of a given article and that of a certain brand the bond of greatest familiarity. Perhaps the highest degree of familiarity is represented by such associations as: Romeo and Juliet, or 1492 and Columbus' discovery of Ameica, or *pro and con,* or Royal Baking Powder, and the like.

In many cases an individual may be able to tell from his past experiences that a certain commercial product has become the most familiar brand to him; and he may also be able to assign a reason. If, then, under the condition of our experiment, the most familiar brand actually occurs first in his mind, he may give as the reason for its occurrence that particular fact of his past experiences which helped to make this brand his most familiar one. On the other hand, the associative bond may be of such an age and degree of automatization that the person is absolutely unable to give any reason whatsoever for thinking first of the familiar brand, beyond the mere statement that it came to his mind first of all or that it was the most natural idea for him to think of. We have found a few such cases reported by our subjects.

It may sometimes happen that the idea of the most familiar brand is not the first one to occur, because there may be certain factors in the general situation which temporarily strengthen a weaker bond formed between a certain article and one of its less familiar brands. Here again a person is in most cases able to tell which particular factor induced the recall of the less familiar brand and mention this factor as the reason why he thought of the brand first. Actual examples of such cases are indicated by reasons like the following: "I saw this brand last evening, but never used it," or "Heard a joke about it (brand A), use (brand B)." In the first example the factor of recency, in the second, the factor of vividness was responsible for the first occurrence of the idea of a seemingly less familiar brand.

There are, of course, cases where the recall of the most familiar brand is further strengthened by some favorable factor in the general situation, so that this factor may be mentioned as the main reason for the occurrence of the brand, while as a matter of fact it may be only a secondary or contributary reason. It is therefore impossible to discover how many of the reasons given indicate greatest familiarity and which or how many imply that a less familiar brand has been temporarily so strengthened as to occur first in the mind of the subject. However, it was not our purpose to study the familiarity of different brands; such a problem could have been investigated much more directly by asking the subjects to state the brands with which they are most familiar.

III. *Commercial Brands*

The results of our investigation with regard to the first occurrence of commercial brands according to our instructions are summarized in Table I.

TABLE I.

ABSOLUTE FREQUENCIES OF VARIOUS KINDS OF BRANDS OF ARTICLES

1	2 Article	3 No. of brands named	4 Most freq. brands	5 2nd freq. brands	6 Most and 2nd freq. brands	7 Miscel. brands named	8 No. brands named
2	Garter	12	192	85	277	12	11
3	Underwear	17	248	18	266	30	4
4	Camera	18	167	52	209	82	9
5	Fountain-pen	19	146	72	218	82	..
6	Watch	20	97	60	157	143	..
7	Baseball	23	179	53	232	42	26
8	Toothpaste	25	155	78	233	61	6
9	Averages	19	170	60	227	65	8
10	Collar	35	224	19	243	51	6
11	Shaving tool	35	162	17	179	101	20
12	Soft drink	36	194	11	205	90	5
13	Tobacco	37	100	57	157	139	4
14	Soap	42	121	39	160	140	..
15	Penknife	46	168	14	182	79	39
16	Hat	47	149	35	184	94	22
17	Averages	40	160	27	187	99	14
18	Magazine	54	72	39	111	178	11
19	Shirt	56	73	44	117	143	50
20	Candy	59	38	31	69	196	35
21	Clothes	61	86	45	131	144	25
22	Shoes	78	58	21	79	210	11
23	Notepaper	93	21	13	34	178	88
24	Averages	67	58	32	90	175	47
25	Grand total	812	2640	793	3433	2195	372
26	Grand average	40.6	132	39.6	171.4	110	18.6
27	Ratios		7 :	2 :	9 :	6 :	1

A glance at column 3 of this Table will show that our 300 subjects were familiar with 812 different brands of 20 articles or about 40.5 brands per article. Furthermore, column 8 shows that there was not a single person among these 300 men who could not mention immediately some commercial brand of fountain-pen, soap, and watch. Only in 372 of the 6,000 possible cases, or in 6.2 per cent., did any brand fail to occur within the time allowed. This number ought to be slightly increased, perhaps to 7 per cent., because there were a few times when it was impossible to tell whether the names mentioned as brands were or were not names of local dealers. All other cases in which the name of a local dealer or a special variety of an article (for example, straw-hat) was wrongly mentioned are included in the last column, headed "no brands named."

According to the frequencies of various brands our twenty articles fall into three groups, as is indicated in Table I. Beginning with the article of which the fewest number of different brands were mentioned, namely garter, of which 12 brands or trade-names were quoted by our subjects, and proceeding to the article with the largest number of different brands, we find in the first group the following articles: garter, summer-underwear, camera, fountain-pen, watch, baseball, and toothpaste. This group results in an average of 19 brands per article. To the second group belong: collar, shaving tool, drink, tobacco, soap, penknife, and hat, with an average of 40 brands per article. The last group includes: magazine, shirt, candy, clothes, shoes, and note-paper—an average of 67 brands per article.

These three groups show great similarity in other respects. For example, with regard to the inability of naming any brands, the first group has also the lowest average of such cases, namely 8 per article; the next group has an intermediate number of 14; and the last group has the highest average, namely 47 per article. In other words, the fewer the number of brands mentioned, the smaller is the likelihood of the inability to mention any, and conversely. Logically one might have expected the opposite result, namely, the more brands of an article are known to exist the less likely would be the inability to mention any one brand. The actual fact as revealed by our Table may probably be explained from the principle that the fewer brands of an article are known the more is everybody apt to be familiar with some one of the few, and conversely.

This explanation is strongly favored by the results of columns 4 to 7. From column 7 we find that the fewer brands of a given article are known the smaller is the number of people who mention the less widely known brands, and conversely. In the case of the articles of the first group, there were on an average only 65 of our 300 subjects, that is 22 per cent., who mentioned what we have called miscellaneous brands, that is, brands which in frequency rank from third to last place. Similarly for the second group; here we have 99 subjects or 33 per cent. who mention miscellaneous brands; while for the third group there were 175 subjects or 58 per cent. who think of some miscellaneous brand first.

Another confirmation of our principle of explanation is found in column 4. According to it, the fewer brands of an article are known the greater is the frequency of the most widely known single brand. Thus the average number of subjects who mention the most widely known single brands in group 1 is 170 or 57 per cent.; the corresponding average for the second group is 160 subjects or 53 per cent., and the average of the third group is 58 subjects or 19 per cent. Here the difference between the first and second group is very small, but that between the second and third group is very large. Consequently the opposite relation must be expected to hold with the second most widely known or second most frequently mentioned brand, as is shown in column 5. Combining now the results with the most frequent and the second most frequent brands, as is done in column 6, and comparing these two most frequent or most widely known brands with all the other miscellaneous brands, we have a further verification of the explanatory principle stated before, namely, the fewer brands of a given article are known, the more widely will one or two brands of that article be known. This fact is probably the psychological reflection of the economic effects of monopoly; however, we are not concerned in this place with economic explanations.

Before advancing to the next general phase of our results, it is interesting to note briefly the grand totals of Table I. As has been pointed out already, our 300 subjects could name 812 different brands of 20 articles, or on an average about 41 brands per article. Furthermore, for every person who could not mention any brand of a particular article there were six persons who knew a variety of miscellaneous brands and seven persons who mentioned the same brand as the most frequent. In other words, our 300 subjects whose homes were located in eight widely separated geographical regions of the country show a "community of ideas" with regard to commercial brands of articles in everyday use which amounts to 43 per cent. for the most widely known varieties, and to 13 per cent. for the second most widely known varieties of brands. Such a result is probably due solely to the nation-wide advertising campaigns conducted by many of our large manufacturing and business concerns. We have in our results therefore a very tangible measure of such intangible influences as are represented by the various kinds of advertising methods.

IV. *Reasons*

We may now examine our results from the standpoint of the reasons stated by our subjects for the first occurrence of a particular brand. Again using frequency as the basis for a classification of these reasons, we find a most frequent reason, a second most frequent reason, 38 miscellaneous reasons of varying frequency, and a small number of cases in which no reasons could be given.

A list of the 38 miscellaneous reasons together with their respective frequencies and also the number of articles with which these reasons recur is appended. The phrasing of the reasons is in most cases somewhat condensed from their original form, and reasons of very great similarity are combined. For example, the first reason listed contains such varieties as: "I like it because it wears well," or "Like its taste," or "I admire their style," and the like. The second reason listed includes such statements as "My father uses it," or "Room-mate has one," or "We have it at home," and the like. In the third reason we have combined such statements as "I sold it last summer" with such reasons as "I worked for a firm which handled that product." There is of course some element of arbitrariness involved in this method of combining; and a glance over the whole list will reveal several other possibilities of making combinations that have not been used. For example, the ninth reason "Best on the market," the tenth, "Best known," and perhaps the fifteenth, "Great popularity" might have been combined under the general heading "Reputation." There is, however, little advantage to be gained from these combinations. Their great disadvantage lies in the fact that the list would become too abstract because the phrasing of the reasons would be too different

LIST OF 38 MISCELLANEOUS REASONS

	Frequency of reason	No. of article	Class
1. A brand is liked because of its special characteristics	163	18	A
2. Friend uses brand, used at home, etc.	95	13	B
3. I sold this brand (worked for firm)	84	18	C
4. Saw it displayed in store or window	69	11	E
5. This brand has widest use	67	12	A
6. I prefer this brand (it is my favorite)	60	9	A
7. Am acquainted with person selling this brand	56	14	B
8. Heard of it (saw it, etc.) recently	52	14	C
9. "Best on the market"	50	10	D
10. "Best known" (has best reputation)	43	9	D
11. Factory near my home town (made near home)	41	11	E
12. This brand is frequently seen	37	8	C
13. Used by railroads, leagues, schools	35	2	D
14. First brand I knew or learned about	34	11	C
15. Great popularity, everybody likes it	26	8	D
16. I hear most about this brand	26	8	C
17. "Standard" (considered the standard brand)	24	9	D
18. I dislike the brand, hate it, "never again"	21	6	A
19. I had some accident with this brand	20	10	B
20. "Only brand known to me"	18	8	B
21. Peculiar name, odd, euphonious name	16	10	C
22. I made some special use of brand	16	11	B
23. I pass place where it is made or sold	16	8	E
24. Recommendation	15	6	D
25. Special memories and associations (boyhood)	14	10	B
26. Jokes and puns about the brand	13	6	B
27. Firm has big reputation	12	6	D
28. Price, its cheapness, most expensive	11	8	A
29. Its name same as that of subject	8	6	B
30. Historical associations with brand	8	5	B
31. Criticisms made or heard of brand	6	2	B
32. I received one of this brand as present	5	4	B
33. Associated with familiar personage	5	4	B
34. "Good tradesmark"	5	2	D
35. I see one of this brand before me now	5	2	B
36. I have always desired one of this brand	4	2	B
37. It is made by the largest manufacturer	3	2	D
38. Novel brand, latest out, etc.	3	2	C
Total	1186		

from those actually stated by our subjects. Furthermore, several significant, though perhaps small, shades in meaning would be eliminated by a further condensation of individual items.

We may, however, classify the 38 miscellaneous reasons into the following groups:

A. Reasons involving personal estimates of brands,
Nos. 1, 5, 6, 18 and 28. . . . . .Total, 322 cases

B. Reasons revealing some personal emotional touch,
Nos. 2, 7, 19, 20, 22, 25, 26, 29, 30, 31, 32, 33,
35 and 36.................................Total, 273 cases

C. Reasons referring to miscellaneous personal experiences,
Nos. 3, 8, 12, 14, 16, 21 and 38..................Total, 252 cases

D. Reasons containing impersonal estimates of brands,
Nos. 9, 10, 13, 15, 17, 24, 27, 34 and 37...........Total, 213 cases

E. Reasons referring to special localities,
Nos. 4, 11 and 23................................Total, 126 cases

The titles of these groups indicate the underlying criteria for classification which are based on a detailed examination and psychological interpretation of the phrases actually employed by our subjects. The list of the reasons given on another page makes reference to this classification in the last column by the letters A, B, C, D, and E. The first three groups refer to our subjects' personal experiences with the commercial brands and total 847 cases or two and one-half times as many as groups D and E, which total only 339 cases and contain reasons of an impersonal nature. These proportions between personal and impersonal references to the brands are somewhat changed if we add to the first three groups the most frequent reason of all, namely that of personal use or ownership, and to the last two groups the second most frequent reason, that of advertising. Under these conditions the reasons of a personal nature occur only twice as often — namely in 3,683 cases — as the impersonal reasons, which occur in 1,853 cases.

The relation of the frequency of miscellaneous reasons to the different articles is indicated in Table II, column 7. The greatest number of miscellaneous reasons occur with magazine and baseball, namely 121 and 120 respectively, thus giving these two articles first and second rank respectively, as is shown in column 8. The decrease in number of miscellaneous reasons for the various articles is very gradual; the smallest number and therefore the lowest rank is reached by garter with a frequency of 22. The average number of miscellaneous reasons for all articles is about 59. Miscellaneous reasons are given in a total of 1,186 cases which constitute 19.77 per cent. of all 6,000 cases or 21.42 per cent. of all the reasons mentioned in this study.

The inability to assign any reasons for the first occurrence of ideas of commercial brands is indicated in columns 9, 10, and 11. To the mere inability, as shown in column 10, there must be added the cases where no brands could be mentioned, as is shown in column 9; column 11 gives the rank as based on column 10. With two articles, namely watch and soap, we find no inability to state reasons, while with baseball this inability is greatest, occurring 14 times.[2] On an average we find 4¾ cases per article in which no reasons can be assigned, or a total of 95 cases out of 5,628 possible cases, that is less than 2 per cent. This low number shows that the task of telling why the idea of one kind of brand occurs in mind before the idea of some other brand is easily performed even by subjects untrained in psychological introspection.

In column 12 are shown the total number of different reasons men-

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[2] In the case of clothes there are more reasons than brands mentioned, which is due to the fact that here more than with any other article names of local dealers were mentioned as brands and had to be classified under "no brands."

TABLE II

ABSOLUTE FREQUENCIES AND RANKS OF REASONS FOR RECALL OF BRANDS

1	2	3	4	5	6	7	8	9	10	11	12
		Freq. of Use		Freq. of Adv.		Misc. Reasons		No Reasons			No. of reasons named
2	Article	No.	Rank	No.	Rank	No.	Rank		No.	Rank	
3	Fountain-pen	207	1	58	15	30	16.5	5	5	12.5	15
4	Collar	197	2.5	69	11	24	19	10	6	10.5	12
5	Watch	197	2.5	43	18	60	10	..	..	2	22
6	Toothpaste	193	4	65	13.5	30	16.5	12	6	14	15
7	Garter	186	5	78	9	22	20	14	3	8	17
8	Shavingtool	183	6	68	12	29	18	21	1	4.5	17
9	Underwear	173	7	76	10	40	13	11	7	15.5	14
10	Shoes	167	8	55	16	67	8	12	1	4.5	14
11	Clothes	163	9	86	7	33	14	18	+7	2	15
12	Soap	147	10	121	3	32	15	..	..	2	13
13	Magazine	141	11	16	20	121	1	22	11	20	18
14	Notepaper	125	12	31	19	53	12	91	3	8	19
15	Shirt	123	13	65	13.5	54	11	58	8	17.5	22
16	Camera	117	14	99	4	65	9	18	9	19	15
17	Hat	104	15	90	6	77	5.5	29	7	15.5	21
18	Baseball	93	16	49	17	120	2	40	14	21	17
19	Soft drink	85	17	134	2	72	7	8	3	8	13
20	Penknife	83	18	92	5	78	4	47	8	17.5	22
21	Tobacco	76	19.5	137	1	77	5.5	9	5	12.5	20
22	Candy	76	19.5	82	8	102	3	39	4	10.5	20
23	Total	2836	..	1514	..	1186	..	464	95	..	341
24	Average	142		76		59		23	4.75		17
25	% 6000	47.26		25.23		19.77		7.73			
26	% 5628	50.40		26.90		21.10					
27	% 5536	51.23		27.35		21.42					

tioned with each article. They vary from 12 to 22 and average about 17 per article.

The most frequent reason, aside from the group of miscellaneous reasons, for thinking of a certain brand of a given article is indicated in Table II, column 3, by the word "Use." This term means in all cases personal use or ownership by the subject, either in the past or in the present, or even intentional future use. Such statements of reasons as the following are typical: "I used to wear this brand," or "I bought one of this kind," or "Am using it everyday," or "I own one," or "Shall buy it this afternoon." This kind of reason is the most frequent one mentioned with 16 articles, but is only the second most frequent reason with candy, drink, penknife, and tobacco. The articles as listed in the Table are given in the order from greatest frequency of the reason "use," namely 207 with fountain-pen, to smallest frequency, namely 76 with tobacco and candy. The average frequency of this reason is about 142 per article, and it occurs in a total number of 2,836 cases. This number constitutes 47.26 per cent. of all 6,000 cases, or 50.4 per cent. of all 5,628 cases in which a brand was mentioned, or finally 51.23 per cent. of all 5,536 cases in which a reason was mentioned.

We must also consider that several of the miscellaneous reasons involve this factor of personal use or ownership. For example, almost the whole group A (with the exception of the fifth reason, "widest use") as well as reasons 19, 22, and 32 of group B imply this factor. This would add a total of 296 cases to the 2,836 original cases. We have in these 296 cases the best illustration of the fact indicated before that personal ownership or use is probably the underlying reason for the maximal familiarity with a certain brand which is either not recognized as such or has become so self-evident or automatized and so much taken for granted that it does not seem to the subjects to suffice as a reason for recalling the brand first. They are therefore led to search their minds for some more particular reason.

But even aside from these additional cases our results of column 3 alone show that *in one case out of two a person will think of a commercial brand of a given article because of his personal ownership or previous use of that same brand.*

The second most frequent reason with sixteen of our articles and at the same time the most frequent reason with the remaining four articles is briefly indicated by the word "advertisement," and its frequency with the different articles is shown in column 5 of Table II. In many cases this reason is given in such specialized forms as: "I saw it advertised in a streetcar," or "I remember the cover of a Saturday Evening Post," or "Large poster in lunch-room;" sometimes it is stated more briefly in such phrases as "Widely advertised" or the like; and finally familiar phrases or slogans from certain advertisements are quoted. This reason is most frequently mentioned with tobacco, 137, and least frequently with magazine, namely by 16 subjects. The total frequency is 1,546 cases, which constitutes 25.23 per cent. of all 6,000 cases, or 26.9 per cent. of all cases in which a brand is mentioned, or 27.35 per cent. of all the reasons stated. The average frequency per article is 76 or slightly more than half the frequency of the first reason (use). In other words, in only one case out of four does a person think of a commercial brand of a given article because he has been impressed by the advertisements of this brand. The ranks which the different articles attain on the basis of this reason are given in column 6. It is to be expected that an article which occupies a high rank on the basis of the most frequent reason will occupy a considerably lower rank on the basis of the second most frequent reason, and conversely. Exceptions to this relation may be explained by reference to the frequency of miscellaneous and no reasons. Thus with shirt there occur 50 cases of no brands, while with baseball there occur 120 cases of miscellaneous reasons.

The fact that three of the four articles with which advertisement is stated as the most frequent reason and use as the second most frequent reason involve personal consumption (namely soft drink, candy, and tobacco) make it seem plausible to assume either that among our 300 subjects this personal consumption was actually very infrequent (about one person in four), or else that many persons hesitated to admit that such personal use was the main reason for thinking of the brands. The fact that such use is regarded as undesirable by many people is possibly responsible for the infrequency of this reason.

We have thus found that personal use or ownership is by far the strongest reason for thinking of a certain commercial brand first. The obvious question which now arises is: what are the reasons for originating this personal use? Does our investigation throw any light upon this problem? I believe it does, and in a twofold way.

In the first place, the following considerations, which are suggested by our investigation and its results, must be taken into account. There are doubtless many cases in which the original use of a given brand of article is due to the fact that it has been used in the home of the parents of a person for some time before he had any opportunity to buy the article for himself. This is very likely the case with articles like soap and toothpaste. On the other hand, with such articles as collar, garter, shaving tool, underwear, shoes, clothes, shirt, hat, and penknife, our subjects might have acquired the original use from older male members of their families. To be sure, imitation of elders is a very strong factor in adolescent boys, especially before they have found themselves or have been away from home for any length of time. As soon, however, as this moment arrives, they are just as likely to do something entirely different from what was done at home as to continue to imitate, if for no other reason than to assert their own individuality. It is probably at such moments that they are most easily induced by one factor or another to try some new brand of a given article. Among these factors advertising as well as some of the *miscellaneous reasons* will exert a *strong influence*. Those miscellaneous reasons would of course be eliminated which involve previous use of a brand, that is, the 296 cases mentioned before, or 5.3 per cent. of all the reasons given.

We *may now assume with a high degree of probability that advertising as well as the remaining miscellaneous reasons have been as potent in originating personal use or ownership as they were in suggesting the present brand.* If this assumption is correct, then the *relative strength of advertising as compared with the remaining miscellaneous reasons* is as 27.35 is to 16.12 (i. e., 21.42-5.3), or roughly 5:3. *That is to say, in all those cases in which the first cause for using a certain brand of article is not the fact that the same brand is used in the home of the person's parents or relatives, advertising has five chances out of eight for determining which brand a person may begin to use of his own accord.* Such *factors as working for a firm which carries the brand, store and window display, extensive use of the brand by others, impersonal estimates of the value of the brand, acquaintance with persons selling it, frequent sight of it, its popularity, its peculiar name, recommendation by others, jokes about it, good* tradenames, or the novelty of the brand — all these factors taken together have only three chances out of eight for influencing a person to the extent of inducing him to use a brand for the first time. But this conclusion must remain hypothetical until our theoretical assumption is supported by experimental evidence.

The second way in which our investigation may help to answer the question: what factors induce a person to use a certain commercial brand of article for the first time? is found in another set of data which we obtained from two groups of women subjects. We must however defer their discussion to some future occasion.

V. *Classification of Articles*

We will now continue to study our present data from a third point of view, by classifying our twenty articles into those of necessity or daily use, those of luxury or occasional use, and those of a mixed nature which nevertheless incline strongly toward the first group and may therefore be called quasi-necessities. This classification is carried out in Table III according to the same rubrics as Tables I and II, at least to the extent of showing the most significant similarities and differences between the three groups. We have also included the averages of the combined data of the necessities and the quasi-necessities, in row 19.

An inspection of Table III reveals the fact that on the average the necessities and even more so the quasi-necessities show a much greater absolute frequency of the most frequent brands than the luxuries. The average of the first group is 133, the second 152, (combined 140), and the last 116. A similar difference, although not so marked, occurs with the second most frequent brands, the corresponding averages being 46, 42 (or combined 44), and 34. On the other hand, there is no difference between the three groups with regard to the absolute frequencies of the miscellaneous brands. Again, the necessities and quasi-necessities show only small averages for the cases in which no brands could be named, 16 and 6 respectively (or 13 combined), while in the case of the luxuries the average rises to 27. In other words, there is much greater readiness to recall some commercial brand in the case of articles which are necessary and in daily use than in the case of luxuries, and furthermore, there is much greater "community of ideas" or likelihood for more people to think of the same commercial brands in the case of necessary articles than there is in the case of articles which are used only occasionally and are not necessities. If this relation, which we found to hold among 300 college men, could be shown to have a more general validity, it would indicate that commercial brands in necessities or articles of daily use could gain a control or even obtain a monopoly of the market through advertising more easily than could brands of luxuries or articles used only occasionally.

With regard to the number of reasons named we find only a very slight difference in the case of the second most frequent reason, namely advertisements. Here the necessities have an average frequency of 89, the quasi-necessities 61 (or combined 73), and the luxuries 80. On the other hand, the reason of personal use or ownership has an average frequency of 160 for the necessities, 190 for the quasi-necessities, (or combined 170), and only 99.5 for the luxuries. Conversely, the number of miscellaneous reasons average 42 and 40 for the first two groups, and 86 for the last. Similarly, the cases in which no reasons could be given for the occurrence of a given brand average twice as great a

TABLE III

FREQUENCIES OF BRANDS AND REASONS FOR CLASSIFIED ARTICLES

1	2	3	4	5	6	7	8	9	10
		No. of brands named				No. of reasons named			
2	Necessities or Daily Use	Most freq.	2nd freq.	Misc.	None	None	Use	Adv.	Misc.
3	Soap	121	39	140	.	..	147	121	32
4	Toothpaste	162	78	101	6	6	193	65	30
6	Collar	224	19	51	6	4	197	69	24
6	Shoes	58	21	210	11	1	167	55	67
7	Garter	192	85	12	11	3	186	78	22
8	Hat	149	35	94	22	7	104	90	77
9	Clothes	86	45	144	25	+7	163	86	33
10	Shirt	73	44	143	50	8	123	65	54
11	Total	1066	366	995	131	29	1280	629	339
12	Average	133	46	124	16	4	160	89	42
	Quasi-Necessities								
13	Fountain-pen	100	72	139	..	5	207	58	30
14	Watch	97	60	143	..	..	197	43	60
15	Underwear	248	18	30	4	7	173	76	40
16	Shaving tool	162	17	101	20	1	183	68	29
17	Total	607	167	413	24	13	760	245	159
18	Average	1152	42	103	6	3	190	61	40
	Necessities and Quasi-Necessities Combined								
19	Average	140	40	117	13	3.5	170	73	41.5
	Luxuries or Occasional Use								
20	Tobacco	100	57	139	4	5	76	137	77
21	Soft drink	194	11	90	5	3	85	134	72
22	Camera	157	52	82	9	9	117	99	65
23	Magazine	72	39	178	11	11	141	16	121
24	Baseball	179	53	42	26	14	93	49	120
25	Candy	38	31	196	35	4	76	82	102
26	Penknife	168	14	79	39	8	83	92	78
27	Notepaper	21	13	178	88	3	125	31	53
28	Total	929	270	984	217	57	796	640	688
29	Average	116	34	123	27	7	99.5	80	86

frequency for the last group, named seven, as for the first two groups. Comparing now the relative frequencies of the three sets of reasons with each other, group by group, we find the following relations: In the first group, advertisements are more than twice as frequent as the miscellaneous reasons, but only a little more than half as strong as use. In the second group, use has become three times as strong as advertisements, and the latter is only one and one-half times as strong as the miscellaneous reasons. With the last group, finally, the three sets of reasons are very nearly equal in their frequencies and averages, use leading with 99.5, then miscellaneous reasons with 86, and finally advertisements with 80 as average. This last figure is so low on account of the small influence which advertisements seem to exert in the case of magazine and notepaper. As a matter of fact, these two articles have only recently been subjected to extensive advertising campaigns, the results of which are not yet sufficiently felt to manifest themselves in experiments of our sort.

VI. *Locality.*

The last viewpoint from which we wish to discuss our results in this paper is that of locality. In Table IV our data are classified according to the eight states in which the experiment was carried on. The total number of cases obtained in each state is given immediately below each state. All other numbers in the Table represent percentages. The percentages of the most frequent brand range from 36.0 in Illinois to 54.5 in Pennsylvania, with an average for all states of 46.0. The second most frequent brand obtains the lowest percentage in New York, namely 11.0, and the highest in Texas, namely 17.5. The miscellaneous brands are mentioned most frequently in Minnesota, with a percentage of 32.5, and least frequently in Texas, namely 19.0. The cases in which no brands were named occurred most often in Illinois, with 11.0 per cent.; and least often in Pennsylvania, where no such cases occurred. There are also cases where two or more brands are mentioned equally often either as first, or second, or miscellaneous brands; their percentages are given in the eighth horizontal row as duplicates. The averages for all eight states are given in the last vertical column. There is no state which approaches these averages very closely; perhaps the results from Georgia most nearly resemble them.

In a similar way the percentages of the various kinds of reasons are listed in the rest of the Table. Here, however, we find that the individual states approach the general averages much more closely. The results from Minnesota are most, those from New York are least, like the general averages. The results from New York fall farthest below the general average with regard to "use" and "advertisements;" and conversely, they go highest above the general averages with "miscellaneous" and "no reasons." Pennsylvania, which had no cases of inability to mention commercial brands, has consequently also the lowest percentage for inability to give reasons. The explanation of this phenomenon may probably lie in the fact that the subjects who took this test were also students in a course in business psychology.

Other geographical peculiarities, which are not revealed by Table IV, are such minor important facts as the following. The fact that a large concern which manufactures some article of our list is located near the place of experimentation in one state or another will naturally tend to give to this brand a strong priority over other brands. This factor has, however, never shown its influence to the extent of changing the results of the most frequent brand or reason in that

TABLE IV

PERCENTAGES OF BRANDS AND REASONS, FOR EIGHT LOCALITIES

1	2	3	4	5	6	7	8	9	10	11
2	Localities...	Ga.	Ill.	Mass.	Minn.	Mo.	N.Y.	Pa.	Tex.	Total
3	No. of cases.	400	460	600	1920	2000	260	200	160	6000
Percentages of Brands										Aver.
4	Most. freq..	50.0	36.0	41.0	41.2	52.0	43.5	54.5	50.0	46.0
5	2nd freq....	16.0	11.8	17.0	16.6	15.0	11.0	17.0	17.5	15.0
6	Miscel......	23.0	29.2	28.0	32.5	30.0	32.0	26.0	19.0	27.5
7	None	5.0	11.0	8.5	7.3	3.0	9.0	....	9.0	6.6
8	Duplicates..	6.0	2.0	5.5	2.4	....	4.5	3.5	4.5	4.9
Percentages of Reasons										
9	Use........	46.0	40.2	40.0	44.0	57.0	36.3	41.0	42.5	43.4
10	Advertising.	34.0	21.5	29.0	24.5	22.7	20.0	36.5	35.0	27.9
11	Miscel......	16.5	25.7	18.7	22.5	16.0	29.7	21.5	12.5	20.0
12	None.......	3.5	12.6	12.3	9.0	4.3	14.0	1.0	10.0	8.4

state. Another peculiarity is the naming of some brand after a locality situated near a place of experimenting. This factor has occurred in only one article and state; and there it has not influenced the results to any important extent. From a general comparison of the different states with each other the writer has gained the conviction that further data from college men of other states will not materially change his results. It may, however, be possible that with entirely different types of individuals, for example, with older men or with less well-educated people, certain significant modifications of these results may be obtained. The discussion of the type of subjects and of their sex must be left to a future occasion.

VII. *Summary and Conclusions*

The results and conclusions of the present investigation may be summarized as follows:

1. Our 300 subjects could name 812 different brands or trade-names of 20 familiar articles, or 41 brands per article.
2. In about 7 per cent. of all 6,000 cases they failed to name any brand.
3. The absolute frequencies of different brands for the various articles differ widely, ranging from 12 to 93.
4. The fewer brands of a given article are known, *the more widely* one or two brands of that article are known.
5. The "community of ideas" with regard to commercial brands is 43 per cent. for the most widely known brands and 13 per cent. for the second most widely known brands. This fact is perhaps the most tangible measure of the variable influences of advertising.
6. In one case out of two a person will think of a commercial brand of a given article because of his personal ownership or previous use of that brand.
7. Advertising is the second most frequent reason for recalling commercial brands of familiar articles, being about one half as effective as use.
8. The 38 miscellaneous reasons for recalling brands of articles taken collectively are less effective than advertising alone.

9. Reasons involving a personal element are twice as frequent as reasons of an impersonal nature.

10. From 12 to 22 different reasons are given per article, with an average of 17.

11. On purely theoretical grounds, and aside from local influences, advertising seems to have five chances out of eight for determining which brand a person may begin to use of his own accord; similarly, all other miscellaneous reasons together have only three chances out of eight.

12. There is much greater "community of ideas" with regard to brands of articles of necessity and quasi-necessity than with articles of luxury and occasional use.

13. Previous use is a much stronger reason for recalling brands of articles of necessity than for recalling brands of articles of luxury.

14. There were no marked differences, either as to brands of articles or as to the reasons for recalling them, between the eight widely separated geographical regions of this country represented in this investigation.

BOOK REVIEWS

WELLS, F. L., *Mental Adjustments.*. New York: D. Appleton and Company. 1917. Pp. xiii+331.

Dr. Wells' book is one of several recent attempts to apply the insight into the fundamental mechanisms of human behavior afforded by psychoanalysis to guiding normal individuals along the paths of mental efficiency and happiness. More particularly it is designed to give those responsible for the formation of character in others the knowledge of the forces to which personalities are subject which will permit the wisest guidance to mental adjustment and its conscious aspect, happiness. Starting with a dynamic conception of mind as a sum of fundamental trends or directions of expending vital energy, the author first offers a discussion of the causes of failures of adjustment. In the animal series maladaptation most frequently comes about through the appearance of exceptional situations for which the normal reactions are inappropriate. In human individuals the maladaptation is usually conditioned by the remoteness of the reaction from the end to which it is directed, or internally through the variety of trends which must be satisfied, with the possibility of conflict. The most striking conflicts rise about the sexual trend owing to its less immediate relation to the individual's survival, its great complexity and lability, and the resistances which have grown up around it; its internal conflicts are on the whole greater than the external difficulties which surround it. One of the chief mechanisms of maladaptation is the shirking of effort necessary to realize the fundamental trends whether by minimising the value of the thing desired, or imagining a realization. A further example of waste of mental energy is found in "autistic" thinking, solutions and explanations by superficial associations which fail to meet the test of concrete reality; this type of thinking is characteristic of maladaptation whether in primitive man, pathological cases, or in the phantastic life of dreams. The conflict of trends often manifests itself in pathological dissociation from the main personality; a chapter is devoted to the discussion of typical examples chiefly from the writer's own observations. He brings out the complex and unstable structure of the mind, with the possibility of the dissociation of one trend from any of the others, and the importance of the unconscious. "Man's special faiths, interests, hobbies, friendships, enmities, ambitions and infatuations are fashioned not from the fraction of experience he can remember, nor yet from the innate features of being he cannot control; but from a body of unconscious experiences vaster than knowledge, which imparts to the objects of consciousness, by affective transference, their human values." A special chapter is devoted to the continuity of emotion (persistence of the emotion independently of the idea to which it attaches) and the possibility of sublimation in the transference of the affect of childish sources of enjoyment to useful trends of conduct. Perhaps the chief differences in character lie in the readiness with which affects transfer from one pursuit to another, and the direction of this transfer is what makes the difference between the superior and the inferior personality. The final chapter contains a conception of all mental trends as "balancing" the output of mental energy, and of happiness as the conscious phase of the adjustment which results from the balance of the supply of energy with its expenditure. He brings out the mutual consistency of the fully developed economic and erotic trends, the biological significance of social trends, and the minor, in a narrower sense "balancing" values of social service, religion, and recreation, introduced to provide an outlet for the energy left unexpended by the fundamental trends. In conclusion he offers pertinent suggestions towards education from the standpoint of the psychopathologist. He emphasises the necessity of directing education along the lines of fundamental trends, leading to a mastery of one's economic existence and love-life, as opposed for example to the cultivation of intellectual resources for use when other satisfactions fail, the importance of willing competition in the natural striving of one's fellows leading to normal self-assurance, the encouragement of the actively tangible and concretely serviceable ideals that are likely to bring the best adjustments towards life. The book is written in a non-technical, concrete, and readable style (its chief defect lies perhaps in a certain looseness of composition) and succeeds in conveying an illuminating, and at no time exaggerated, point of view and much pertinent counsel.

Clark University. R. B. TEACHOUT.

NORBERT J. MELVILLE. *Standard Method of Testing Juvenile Mentality.* With an introduction by William Healy. J. B. Lippincott Company, Philadelphia, 1917. Pp. xi, 142.

This little book is a convenient manual for mental examiners who wish to use the 1911 revision of the Binet-Simon tests. According to the Preface, "the writer intends that this manual may aid in the careful training and exact guidance of an ever-increasing corps of competent examiners who will be able to render first aid in juvenile mental crises by means of a brief scientific investigation." As Dr. Healy points out in his introduction to the Manual, "for final diagnosis of the mentality of the individual, the Binet test score is simply one out of several main facts to be taken into consideration. * * * I confess myself particularly interested in this two-fold attempt to devise more exact methods of using this scale, while at the same time absolutely insisting on the setting of sharp limitations to the interpretation of findings by this scale."

Part I describes the general procedure of gathering and analysing the data according to the author's standard or uniform method, which, as he insists, is not another revision or adaptation of the Binet-Simon tests, but merely a minute description of a large number of details of performance which are ordinarily left to the discretion of the examiner. The tests are arranged in parallel series in such a way that those "tests which the majority of investigators thus far reported have shown to be most highly diagnostic in differentiating the mentally deficient from the normal, constitute the first or *a* series of tests; those next in diagnostic value constitute the *b* series, etc." Furthermore, "those tests which involve the use of similar materials or methods are arranged in the same series so that they will be given in sequence;" thus the directions for the Picture Test, which occurs in years III, VII, and XV are all grouped together. "The standardization is based upon (1), the experiences growing out of an application in over a thousand cases of the recommendations of the Buffalo conference on Binet testing, and (2) a comparative study of the methods used by other investigators."

In connection with a discussion of provisional evaluations and classifications of Binet scores the author presents both a general plan of orthogenic case study and also several detailed schemata showing (a), an orthogenic table of provisional mental classification based upon the analysis of the Binet record; (b), a provisional psycho-educational classification involving language ability, Binet age difference, mentality, and scholastic group, and (c) Binet's anatomical limits for subnormal boys, as to height and cephalic diameters. The problems of clinical interpretations are presented in the form of abridged quotations from Binet and Simon's original reports. A long list of general and special directions to examiners, together with specimen copies of standardized recording blanks and explanations for their use, are followed by general rules concerning the sequence of tests and the giving of instructions to subjects.

Part II. contains the actual material to be used in the tests, except the objects. The pictures and drawings are arranged in such a way that they face the subject, while the corresponding directions and explanations for using these drawings or pictures face the examiner. Two pages of sample drawings illustrating the standards for scoring the square, the diamond, and the other two figures, are included in the appendix.

The proper use of this manual should contribute greatly to a more uniform and standardized application of the Binet-Simon tests and help to dispel the widespread fatal notion that a little common sense is all that is necessary for the performance and interpretation of general mentality tests.

L. R. G.

RUDOLPH PINTNER AND DONALD G. PATERSON, *A Scale of Performance Tests*. New York: D. Appleton and Co., 1917. Pp. 217.

One great drawback in most of the mental tests now in use is the necessity of language responses on the part of the pupil examined. Just how much the ability to handle language is indicative of intelligence is a question at issue. The clinical psychologist in the large city is face to face with the problem of the foreign child, the speech defective, the deaf child, and other children with language difficulties. This has led to the type of test now generally known as the performance test, the essential characteristic of which is the elimination of a language response on the part of the child.

The present volume offers a detailed description of the use of fifteen performance tests selected largely on the basis of variety, adaptation to new situations, and freedom from verbal instructions and responses. The remainder of the book is devoted to a discussion of methods of standardizing tests and establishing reliable norms. Data from the fifteen tests described are arranged in tables of distribution and then manipulated in order to show various means of scoring. In the year scale tests are grouped with the supposition that the average child of a particular age will pass all the tests of the year scale at the age in question and all below and none above that year. But a particular child usually passes tests scattered over several years. Credit for these tests leads to the computation of a mental age. The authors then suggest the use of a "median mental age." Given a group of tests which have been adequately standardized and for which the median performance at each age is available, then the measure of an individual's intelligence is the median of all the mental ages which he approximates in all the tests. The authors are inclined to question the validity and justification of the point scale method, especially the arbitrary allotment of credit which Yerkes and Bridges assign to their scale. Two drawbacks are apparent in the point scales: The fact that the cases must be tested on all the tests of the scale to establish valid norms, and that with an individual case all tests must be employed before the results can be used with advantage. The percentile method of scoring offers perhaps the best possibility for future work. The percentile division can be made as small as the delicacy of the tests will warrant. This method is desirable because it permits comparison of an individual's performance with those of other individuals of the same age. Tests may also be omitted and admitted very readily in such a scale. This gives great flexibility to the scale.

C. C. PRATT.

HARRY D. KITSON. *How to Use Your Mind.* Philadelphia and London. J. B. Lippincott Company, 1916. Pp. 215.

The author in the preface states the general purpose of the book. "Educational leaders are becoming increasingly aware of the necessity for teaching students not only the subject-matter of study but also methods of study. Teachers are beginning to see that students waste a vast amount of time and form many habits because they do not know how to use their minds." The recognition of this condition is taking the form of the movement toward "supervised study" which attempts to acquaint the student with principles of economy and directness in using the mind. There are certain "tricks" which make for mental efficiency such as devices for arranging work, methods of review, methods of taking notes and rules for memory. These devices are in some cases the results of psychological experimentation and in others the results of experience. It is the purpose of the author to systematize these experiments and make them available in a textbook.

The book is designated by the author as "A Psychology of Study," being a manual for the use of students and teachers in the administration of supervised study. The text is divided into twelve chapters: Intellectual Problems of the College Freshman; Note Taking; Brain Action During Study; Formation of Study Habits; First Aids to Memory; Concentration of Attention; How We Reason; Expression as an Aid in Learning; The Plateau of Despond; Mental Second Wind; Examinations and Bodily Conditions for Effective Study.

The principles as outlined by Dr. Kitson are not new but have been brought together and systematized in such manner as to make a very readable and interesting text. The volume will be of service to anyone interested in economical and effective methods of study.

A criticism might be made of the treatment of Chapter III, "Brain Action During Study." This chapter contributes little to the effectiveness of the text. It is difficult to see how such a popular and nontechnical treatment would be of any service to the student or general reader.

The author has in no way indicated the principles that are of primary importance. The effectiveness of the book for general use would have been increased if the author had summarized the important principles or rules at the close of each chapter. The reviewer is not sure that the title, "How to Use Your Mind," is justifiable.

J. A. STEVENSON.

WILLIAM A. WHITE. *Mechanisms of Character Formation.* The MacMillan Company, 1916, pp. 335.

This introduction to psychoanalysis brings together into compact and readable form the essential principles of the Freudian psychology.

This, the author believes, "is the psychology which will prove of the greatest pragmatic advantage" since it is the first to realize that a mental event can only be understood as the end result of the past mental life of the individual and of the race. He, therefore, suggests that it be taught in the medical schools in a form similar to that outlined in this book. From a brief historical introduction he passes to the consideration of the "Genetic Approach to the Problem of Consciousness," which with the three following chapters upon the "Unconscious," the "Conflict," and "Symbolism," deals with the general questions "which define the placement of the psyche in the evolutional scheme." Man is to be regarded as a "biological" unit, as the material in and through which energy manifests itself in a constant tendency, with an unremitting effort to develop." This energy, the "libido" or creative force, is the "same in kind whether found at work in the individual cell, in the functioning of an organism, or in the psyche." In order to produce results, this creative force must overcome the resistances offered to the organism by its environment, and hence conflict, the action and reaction of opposing forces, is the fundamental factor in its development. Conflict is the "very root and source of life." While in the lower organisms it is expressed in the tropisms and the reflexes by which the individual adjusts himself to his surroundings, in man it is manifested in the consciousness which arises when the complexity of a situation demands a choice of actions. In the human individual, the creative force takes the fundamental forms of self-preservation and race preservation, both of which early come into conflict with his social environment. The result is a repression of these instinctive tendencies, which are forced down below the conscious level, where they remain as the great submerged mass of the unconscious, "that portion of the psyche which has been built up and organized in the process of development." But the "unconscious in its anti-social and unconventional tendencies can only express itself in consciousness under the form of a symbolism which at the same time effectually disguises its real meaning." The symbol thus serves as a "transmitter" of energy, and as a "transmuter" as well, since by its larger and more universal application it opens the way for the energy to pass into wider and more complex paths.

The remaining chapters of the book are devoted to a more detailed discussion of the means by which this creative energy strives to rise above its limitations and deal with its environment efficiently; the "various mechanisms which are utilized at the psychic or symbolic level in dealing with the two-fold problem of integration and adjustment" of the individual to his environment. Here are discussed the "Dream Mechanisms" familiar to Freudian readers; the "Family Romance," as the author prefers to call the neuroses representing the infantile attachment to the family situation; the "Will of Power," and "Partial Libido Strivings," in which are discussed the abnormalities arising when the check of reality is too strong to be overcome by the vital force, which therefore finds its outlet in ways harmful to the efficiency of the organism. In the chapter upon "Extroversion and Introversion," the distinction is drawn between those individuals whose energy tends to flow out upon the external world, and those whose interest is directed upon their own inner world; while the following consideration of "Organ Inferiority" contends "if at any point. . .an inferior organ is unable to do its share of the work, then the concessions which have to be made to this defect and the compromises that have to be effected as a result of it must ultimately find their expression at the psychological level." In the concluding chapters on the "Resolution of the Conflict" and "Summary and Synthesis," the author again returns to the value of the symbol as the "energy carrier from one level to the next higher level in this process" of development.

Throughout there is a wealth of illustrations drawn from pathological and child psychology, as well as from that of primitive man, in the explanation of the various technical terms. The book is one of the first attempts to gather together and systematize the various principles of psychoanalysis and as such is invaluable as an introduction and a summary in this field.

E. BOWMAN.

DANIEL STARCH. *Advertising: Its Principles, Practice, and Technique.* Scott, Foresman and Company, Chicago, 1914, pp. 281.

As appears from the preface, this book is intended to serve "as a textbook for students and as an introductory handbook for business men." The author has endeavored to combine the practical and the theoretical aspects of the subject in such a way that the practical experiences of business houses, which are quoted at length, may illustrate the underlying principles, and that the discussion of principles may illuminate the practical results of business.

Advertising specialists all over the country agree that Professor Starch has contributed the best book on advertising thus far, considering its simplicity, accuracy and helpfulness.

The contents cover the following phases of advertising: The place of advertising in the business world; problems of advertising; attracting attention; reaching the people; display type,—its attention—value and use; the size of advertisements; emphasis and unity in advertisements, avoidance of counter-attractions; contrast, the use of colors and novel features; borders, eye-movement and attention; mediums,—magazines, newspapers, street railway cards; trade names and trade marks; headlines; illustrations; repetiton and cumulative effect; type and legibility; artistic elements in advertisements; arrangement, balance, and harmony; argumentative advertisements; suggestive advertisements; testing the strength of advertisements; the ethics of advertising.

The organization of the material is excellent. The changes in the methods and ideals of advertising are taken up and illustrated by the type of copy used by the leading firms. The results of investigations by various firms to determine the efficiency of the advertisements are given in detail. Professor Starch presents the results of laboratory experiments, and the relation between these experiments and that "of the advertisement in operation is always clearly shown." But the function of an advertisement is to attract attention, to stimulate interest, and to secure a response, and the psychological principles which underlie the construction of the advertisement itself, are taken up in detail. It should be noted that psychological technicalities are avoided so that the material is easily understood by the average reader.

It is estimated that in the United States eight hundred million dollars are spent annually for the purpose of advertising, and the printed space consumed would cover two thousand square miles. A full-page advertisement in the back issue of a leading magazine for women, for only one issue, cost ten thousand dollars. The problem of the advertiser is a large one, and this book should be looked upon as a primer of the science and practice of advertising.

Teachers of advertising will welcome this text-book for it presents fundamental principles in such a concrete form that the students can readily absorb them. Professor Starch is the first writer to produce a text-book on advertising that anywhere near fills the need. This volume should be read by every one interested in any phase of advertising.

JOHN A. STEVENSON.

The following books and pamphlets have been received:[1]

ELLSWORTH HUNTINGTON. *Civilization and Climate.*. Yale University Press, New Haven, 1915.

Indiana University Studies, No. 32. *Studies in Arithmetic. Edited* by MELVIN E. HAGGERTY, Vol. 3, September, 1916. No. 34. *The Ability to Read: Its Measurement and Some Factors Conditioning it.* Edited by MELVIN E. HAGGERTY, Vol 4, January, 1917.

ROBERT M. YERKES AND HAROLD E. BURT. *The Relation of Point-Scale Measurements of Intelligence to Educational Performance in College Students.* Reprinted from *School and Society,* Vol. 5, No. 123, pp. 535-540. May, 1917.

HAROLD E. BURT. *Auditory Illusions of Movement—A Preliminary Study.* Reprinted from *Journal of Experimental Psychology,* Vol. 2, No. 1, February, 1917.

J. E. WALLACE WALLIN. *The Feebleminded in the State of Missouri.* Reprinted from *The Psychological Clinic,* Vol. 11, No. 2, April, 1917.

—— ——. *A Program for the State Care of the Feebleminded and Epileptic.* Reprinted from *School and Society,* Vol. 4, No. 98, November, 1916.

—— ——. *The Problem of the Feebleminded in its Educational and Social Bearings.* Reprinted from *School and Society,* Vol. 2, No. 30, July, 1915.

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[1] Mention here does not preclude further comment.

NOTES

The following items of general interest are quoted from the Phi Delta Kappa News Letter, (Chicago Chapter), June 1917:

Dr. F. N. Freeman of the University of Chicago, has been directing an investigation of the handwriting of adults by the use of the kinetoscope. The first step of the process is to photograph with the motion picture camera operating at a certain number of exposures per second, usually about thirty, and from a position directly above the page, the whole writing process, forearm, hand, pen, writing, etc., while the subject is in action. Not only the superior but also by an arrangement of mirrors, the lateral and front views of the hand, penholder, and fingers are obtained. The film is then developed and the image projected so as to be greatly enlarged. By running the projectoscope at a desired rate of speed the movements used by the writer are clearly evident and subject to repeated observation. For closer analytical study the individual pictures are projected and the positions of the fingers, hand, arm, and pen studied or even outlined on drawing paper for exact measurements. The speed of the penpoint with the stroke is also clearly shown by noting its position at each exposure and measuring the distance which it passes over between successive exposures.

The movements of the eyes in reading present many unsolved problems. Last year Mr. C. T. Gray made quite an extensive study of the differences in eye movements between good and poor readers. The apparatus which he designed, with a few minor changes, is being used for further study this year (by Mr. A. R. Gilliland). A small bead soldered to a pair of spectacle frames is used to reflect a ray of light on the film by which movements of the head and shifts of the film may be detected. By keeping this bead line as a constant point of reference in reading the films it is possible to determine with relative certainty the exact letter fixated. The problem of the difference between reading aloud and silently is being studied to determine the essential differences in eye movements. It is to be hoped that some light may be gained as to the differences between the mental processes in these activities. The difference in eye movements in reading different sized type is also being studied. Other tests should determine whether we actually see more of the letters than has been supposed.

Dr. H. D. Kitson is engaged in a study of the psychology of proofreading, with an end of determining the factors that influence the speed and accuracy of proofreading, and with the hope of devising tests that will be of assistance in the employment of proofreaders. The last problem is especially carried on by Mr. A. Howell.

An extensive study of the problems of gifted children has been carried on during the past year under the direction of Professor G. M. Whipple at the University of Illinois, with a special fund appropriated for this purpose by the General Education Board. Miss Genevieve L. Coy (M. A., 1915, Columbia University), has given her full time to the problem of selecting mentality tests by means of which children of superior intelligence can be quickly and accurately selected from a heterogeneous group. Mr. T. S. Henry (Ph.D., 1917, Univ. Ill.) has investigated class-room problems in the education of gifted children, while Mr. H. T. Manuel (Ph.D., 1917, Univ. Ill.), made a special study of talents in drawing in adults and children above ten years of age. A special teacher was also engaged last September and connected with the public schools of Urbana, Ill., to teach a class of thirty children selected as superior on the basis of teachers' judgments and school records. The children varied in chronological age between nine years seven months and twelve years three months on October 1, 1916. Their mental ages by the Binet-Stanford scale varied between ten years three months and sixteen years one month, and their I. Q.'s from 99 to 147. The purpose was to determine whether by special instruction these children could master two years' school work in one year. It was found that at least eighty per cent. will be able to enter next fall two grades above the one they entered in the previous year. Miss Coy's results have definitely brought out the fact that teachers' judgments and school records furnish a very unreliable basis for differentiating between normal and supernormal children, but that a few hours devoted to well selected mentality group tests result in a sharp and reliable differentiation between the two groups of children. Miss Coy will probably continue the work of studying supernormal children next year in the Department of Psychology of the Ohio State University.

The Fourteenth Annual Report of the Director of the Carnegie Institute of Technology for the year ending March 31, 1917, includes the Second Annual Report of the Division of Applied Psychology, including the Department for the Training of Teachers and The Bureau of Mental Tests, from which the following items are quoted below:

D. Walter Dill Scott, of Northwestern University, the foremost American authority on psychology in its application to business was secured as Director of the newly-organized Bureau of Salesmanship Research to conduct the five-year experiment in vocational selection described later. Dr. Scott was also appointed to the faculty with the title of Professor of Applied Psychology. During his absence Professor G. M. Whipple of the University of Illinois has been selected to serve as Acting Director of the Bureau of Salesmanship Research.

This coöperative enterprise of thirty business concerns with selling organizations of national scope is concentrating its efforts on a study of the problems of the human element in marketing: the salesman, his selection, training and supervision. The cost of the Bureau is chiefly met by the business firms which contribute $15,000 a year toward the expenses of the research. The Carnegie Institute of Technology in turn furnishes office quarters, laboratories, equipment and supplies. Dr. Scott's research course has already resulted in a volume entitled "Aids in the Selection of Salesmen," containing model forms for application blanks, letters to former employers, interviewers' guides and record blanks and a set of tests to be used as a supplementary means of determining the applicant's intelligence, alertness, carefulness, imagination, resourcefulness and verbal facility—qualities which contribute to effective salesmanship. In this work Dr. Scott has had the help of six research assistants and the coöperation of Drs. B. G. Miner, G. M. Whipple, and W. V. Bingham, head of the Division of Applied Psychology.

Professor C. E. Seashore of the department of psychology at the University of Iowa has recently issued a bulletin, entitled *Vocational Guidance in Music*, in which he describes his newly established Psychology of Music Studio. Nature's gift of musical endowment can be measured by a system of psychological tests which deal with the most salient features of musical talent—sensitivity to tones, the time-sense, the sense of rhythm, the sense of harmony and melody, musical *memory*, *musical imagination*, *musical feeling*, *musical intellect*, and musical expression in singing and playing. From this system of measurements it is possible to decide whether or not a musical education is worth while in any given case, why such an education should be of one kind rather than of another, what musical powers are most promising for cultivation, what powers need special training, what pitfalls are to be avoided, etc. The record obtained from the test of an individual is expressed in a "chart of musical talent." A complete and thorough examination of an individual includes twenty measurements and requires three days of continuous work. The staff of the Studio is prepared to make a limited number of surveys for vocational guidance in music among the children of the public schools. The results of these surveys will, however, be only tentative, yet they may serve "as a sort of drag-net by means of which marked talent or lack of talent will be revealed." The Studio is conducted in connection with the Psychological Laboratory of the University of Iowa; it is in charge of a psychologist and a musician, with a corps of trained assistants who make the measurements by approved psychological methods; the Studio is equipped with apparatus which has been specially designed for this work. This new and unique movement serves as another illustration of the variety of fields of human activity in which the applications of psychology promise to be helpful and fruitful.

Psychological tests of candidates for the aviation corps are now being conducted at the Massachusetts Institute of Technology by Dr. H. E. Burtt, at the University of California by Professor G. M. Stratton, and at the University of Pennsylvania by Professor F. N. Maxfield.

PSYCHOLOGY AND NATIONAL SERVICE

Among the many scientific problems which the war has forced upon the attention of our military authorities there are several which are either psychological or present a psychological aspect. In the opinion of experts many of these problems are immediately soluble and it therefore becomes the duty of professional psychologists to render national service by working on such problems. For this reason a committee on psychology has been organized with the approval of the council of the American Psychological Association, by the National Research Council. This committee consists of J. McKeen Cattell, G. Stanley Hall and E. L. Thorndike from the National Academy of Sciences; Raymond Dodge, S. I. Franz and G. M. Whipple from the American Psychological Association, and C. E. Seashore, J. B. Watson and R. M. Yerkes, Chairman (member of the National Research Council) from the American Association for the advancement of Science.

At the first meeting of the committee, it was voted "that whereas psychologists in common with other men of science may be able to do invaluable work for national service and in the conduct of the war, it is recommended by this committee that psychologists volunteer for and be assigned to the work in which their service will be of the greatest use to the nation. In the case of students of psychology, this may involve the completion of the studies on which they are engaged."

It is the function of this general committee to organize and, in a general way, supervise psychological research and service in the present emergency. Problems suggested by military officers or by psychologists are referred by the committee to appropriate individuals or institutions for immediate attention. Already at the suggestion of the council of the American Psychological Association the chief psychological laboratories of the country have been offered to the committee for such use as the military situation dictates. Moreover, the membership of the American Psychological Association, in response to a letter addressed to it by the council, has responded most promptly and heartily with offers of personal service.

At a meeting held in Philadelphia, April 21, the council of the American Psychological Association, in addition to approving and urging the appointment of a committee on psychology for the National Research Council, authorized the organization of twelve committees to deal with various important aspects of the relations of psychology to the war.

The list of committees with their personnel, so far as at present announced, follows, together with brief comment on the status of their work:

COMMITTEES

Committee on Psychological Literature Relating to Military Affairs.—It is the function of this committee to prepare bibliographies and abstracts of important psychological military contributions for the immediate use of committees, individual investigators, and for publication. Chairman, Madison Bentley, University of Illinois. Dr. Bentley already has rendered valuable service to several of the committees.

Committee on the Psychological Examining of Recruits.—The first task of this committee is the preparation and standardization of methods and the demonstration of their serviceableness. Chairman R. M. Yerkes, Harvard University, W. V. Bingham, H. H. Goddard, T. H. Haines, L. M. Terman, F. L. Wells, G. M. Whipple.

This Committee has prepared a method of group examining, and also varied methods of individual examining. The work, covering a period of four weeks, was generously financed by the Committee on Provision for the Feeble-minded. The methods are now being tested in three army camps and one naval station. The expense of this initial trial, which is made primarily for the further development and perfecting of the methods, is met by an appropriation of twenty-five hundred dollars made by the Committee on Furnishing Hospital Units for Nervous and Mental Disorders to the United States Government. At the present writing, the Surgeon-General of the Army awaits lists of psychologists who are both adequately prepared and willing to serve as psychological examiners.

It is the conviction of the committee that the psychological examiner, by applying specially prepared and adapted methods to recruits in the camps, should obtain measurements valuable alike to line officers, to general medical officers, and to the special officers in charge of the psychiatric hospital units.

It is assumed that the work of the psychologist, although not strictly medical in character but instead vocational, educational and social, will supplement that of the medical examiner by supplying him with information otherwise not available. Further, the psychologist may aid the psychiatrist by detecting and referring to him those individuals for whom careful psychiatric examination is obviously desirable.

Committee on the Selection of Men for Tasks Requiring Special Skill.—This includes the selection and promotion of officers, as well as the choice of men for varied kinds of skilled service. Chairman, E. L. Thorndike, Columbia University, J. C. Chapman, T. L. Kelley, W. D. Scott.

A new method of selecting officers devised by Dr. Scott is now in use in many of the Officers' Training camps.

Committee on Psychological Problems of Aviation, Including Examination of Aviation Recruits.—Chairman, H. E. Burtt, Harvard University, W. R. Miles, L. T. Troland.

Work looking toward the development and thorough testing of methods for the selection of aviation recruits has been authorized by the government and already is in progress in at least one of the institutions where the recruits are being trained.

Committee on the Psychological Problems of Incapacity, Especially

Those of Shock, Reëducation and Vocational Training.—Chairman, S. I. Franz, Government Hospital for the Insane, J. B. Watson, K. S. Lashley.

The task proposed for this committee is a large and difficult one and the chairman plans to organize, in intimate relations with various military activities and agencies, a committee which shall be competent to deal with the varied scientific problems of incapacity.

Dr. Franz has himself developed successful methods for the reëducation of certain paralytics, and according to our information his methods are now used by the Military Hospitals Commission of Canada. It is greatly to be hoped that his own country may be equally ready to avail itself of these methods, and that it may adequately prepare in advance for the extremely important as well as difficult task of rehabilitating maimed and paralyzed soldiers and sailors.

Committee on Psychological Problems of Recreation in the Army and Navy.—Chairman, G. A. Coe, Union Theological Seminary, W. C. Bagley, H. L. Hollingworth, G. T. W. Patrick, J. H. Tufts.

This committee will serve the national cause by coöperating in every profitable way with the committee on military recreation of the Y. M. C. A., and with such other agencies as are immediately concerned with this kind of military aid. Psychologists will find abundant opportunity for the study of psychological aspects of recreational problems.

Committee on Pedagogical and Psychological Problems of Military Training and Discipline.—Chairman, C. H. Judd, University of Chicago.

Committee on Problems of Motivation in Connection with Military Service.—Chairman, W. D. Scott, Northwestern University, H. S. Langfeld, J. H. Tufts.

Committee on Problems of Emotional Stability, Fear and Self-control.—Chairman, R. S. Woodworth, Columbia University, W. B. Cannon, G. S. Hall, J. B. Morgan, J. F. Shepard.

It is probable that in addition to dealing with the special problems of emotional stability this committee will find it desirable to undertake a careful study of incorrigibility.

Committee on Acoustic Problems of Military Importance.—Chairman, C. E. Seashore, University of Iowa, R. M. Ogden, C. A. Ruckmich.

Already the chairman of this committee has interested himself in the relations of the principles of acoustics to various naval situations. Methods of localizing sounds and their utilization for the detection of submarines, the identification of guns, and the locating of batteries are clearly important. These questions are under investigation by the Physics Committee of the National Research Council, with which Dr. Seashore's committee will coöperate.

Committee on Visual Problems of Military Significance.—Chairman, R. Dodge, Wesleyan University, R. P. Angier, H. A. Carr, L. R. Geissler, S. P. Hayes, G. M. Stratton, L. T. Troland.

Chairman Dodge has devised and perfected an apparatus for the measurement of various important aspects of the naval gunner's reaction. This is now installed for trial on a number of battleships. The Committee has also been requested to prepare and recommend to the Navy methods for the selective examining of men for various kinds of service. This work is in progress and its results will shortly be reported to the officials directly concerned.

If the war continues for as much as a year American psychologists will have opportunity to serve importantly, not only in the examining and classifying of recruits but also in the selection of men for positions of responsibility, and in the choice and training of aviation recruits, naval gunners and others in skilled service. It is no longer a matter, as at first appeared to be the case, of inducing military authorities to accept methods of psychological measurement, but instead primarily one of meeting their expressed needs and requests for assistance.

As psychological research along such lines as have been indicated above progresses and as the applicability and serviceability of methods are demonstrated and rendered increasingly clear, it is probable that effective use can be made by the government of all scientists who are skilled in the study and control of human behavior. For after all the human factors in war are as important as are the mechanical and it cannot be doubted that brains and not brawn will decide the great conflict.

R. M. YERKES,
Chairman

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ESTIMATES OF THE MILITARY VALUE OF CERTAIN CHARACTER QUALITIES

By PAUL S. ACHILLES and EDITH MULHALL ACHILLES

The question of the best combinations of character qualities for success in different occupations has long been of interest, but the present necessity for thousands of men to enter a single occupation, that of soldier, lends new interest to the particular question of the best combination of traits for success in military life. Although the breadth and the many possible interpretations of this question preclude a definite answer, the widespread interest in the subject led one of the writers who was a member of the first Officers' Training Camp at Plattsburg Barracks, N. Y., to carry out the following investigation.

The list of character qualities given below was selected, and the procedure consisted in obtaining the rankings of these qualities in the order of their importance for success in military life from a large number of the men. A list of "Qualities for Rating of Executive Ability" already in experimental use by Professor E. B. Gowin of New York University for investigating their importance for business executive was chosen with a view of obtaining possible interesting comparisons. This list, with brief instructions, was printed on blanks as shown on next page, and ratings obtained from one hundred candidates and Reserve Officers attending the training camp at Plattsburg.

QUALITIES FOR THE RATING OF EXECUTIVE ABILITY

For comparison with ratings made by business men, of the following qualities in the order of their importance for success in business life, it is desired to obtain from regular army officers a rating of the same qualities in the order of their importance for success in military life. Put a "1" in front of the quality, the possession of which you consider most important; a "2" in front of the next most important, and so on until you have put a "14" in front of the least important. Consider that every man probably possesses a certain degree of each of the qualities, and rank them according to the desirability of their predominance in any given man for his success in military life.

......**AGGRESSIVENESS**
(Energy, courage, domination by will)

......**APPEARANCE**
(Well groomed appearance, good carriage, pleasing facial expression, voice, etc.)

......**COMPETITIVENESS**
(Interest in playing the military game)

......**CONTROL OF EMOTIONS**
(Freedom from outbursts of anger, touchiness, etc.)

......**COOPERATIVENESS**
(Unselfishness, kindness, cheerfulness, tact, loyalty)

......**INITIATIVE**
(Alertness, imagination, originality, independence in thinking)

......**INTEGRITY**
(Truthfulness, honesty, sincerity)

......**HEALTH**
(Bodily vigor, good sight, hearing, etc.)

......**JUDGMENT**
(Reasoning ability, accuracy in conclusions, ability to profit by experience)

......**OPENMINDEDNESS**
(Reasonableness, teachableness, openness to new ideas)

......**ORGANIZING ABILITY**
(Systematizing, classifying according to functions, planning and delegating)

......**PERSEVERANCE**
(Industry, ambition, concentration)

......**REFINEMENT**
(Courtesy, manners, general culture)

......**SENSE OF HUMOR**

Do the results of these rankings show any marked agreement as to the most valuable qualities for success in military life? Table 1 presents the results obtained from one hundred of the candidates and Reserve Officers at the first Officers' Training Camp at Plattsburg, May 12 to August 15, 1917. The figures under the name of the trait indicate the number of candidates placing the trait in each of the fourteen places. The sums of positions are obtained by adding one times the number of cases the trait was put in position 1, twice the number of cases it was in position 2, etc. Thus if an item had been in position 1 in each of the hundred times the sum would be 100 and if it had been in position 14 each of the hundred times the sum would have been 1,400. The range indicates the lowest and highest position in which the traits were placed. This range is great—indeed in eleven of the fourteen traits it is 1-14, the greatest possible range. There is no distinctly marked agreement as to the exact placement of the qualities. However, a glance a the sums of the positions shows a gap which divides the list in half. This may be taken to mean that the first seven qualities, as a group, are the most valuable for success in military life. The existence of this grouping seems to indicate that possession of all of these first seven qualities is about equally essential, although the part of the table showing the number of men placing each quality in each position shows a rather wide range of opinion. However, the first half of each of the first seven columns adds up to over 50 thus showing that when the table is examined by quarters, it also indicates a fair predominance in favor of these same first seven qualities as being most valuable—judgment, health, aggressiveness, initiative, integrity, organizing ability, perseverance.

It might be supposed from this wide range of opinion among the hundred embryo officers, most of them college graduates, that there is no definitely fixed common ideal gained from history and biography as to the one best combination of qualities for a successful military career. The indications from these results are rather that success in military life is open to men of all sorts of character and does not depend upon any special predominance of certain qualities. On the other hand, the lack of agreement in these results may be due, in part, to the fact that the ratings were all made by novices in the military profession.

For comparison with the above estimates made by men but little acquainted with military life, rankings were obtained from forty-two officers of the Regular Army who were in-

TABLE 1

Position	Judgment	Health	Aggressiveness	Initiative	Integrity	Organizing Ability	Perseverance	Control of emotions	Appearance	Co-operativeness	Openmindedness	Competitiveness	Refinement	Sense of humor
1	22	25	12	11	11	2	5	1	2	1	0	5	1	2
2	21	10	15	13	13	11	3	2	6	1	2	1	2	0
3	14	7	16	21	1	11	9	7	5	3	3	2	0	1
4	19	12	20	1	7	13	5	4	4	2	5	2	3	3
5	8	7	4	15	11	12	12	10	5	3	4	4	2	3
6	3	9	5	7	11	5	20	9	6	7	8	3	3	4
7	6	7	10	13	6	11	12	9	7	4	4	5	4	2
8	2	2	6	4	5	8	9	11	7	12	11	12	3	8
9	1	4	3	4	7	3	13	8	4	21	8	13	7	4
10	2	4	2	3	9	10	5	10	11	13	14	8	15	4
11	2	2	2	6	10	2	1	10	13	14	10	10	11	7
12	0	5	3	1	3	2	4	3	13	10	17	13	18	8
13	0	4	2	1	3	8	0	11	9	7	5	13	25	12
14	0	2	0	0	3	2	2	5	8	2	9	9	16	42
Sum of positions	349	406	469	491	631	635	648	828	895	913	934	948	1096	1127
Range	1–11	1–14	1–13	1–13	1–14	1–14	1–14	1–14	1–14	1–14	1–14	1–14	1–14	1–14

TABLE 2

Position	Judgment	Initiative	Integrity	Aggressiveness	Health	Perseverance	Organizing ability	Control of emotions	Cooperativeness	Refinement	Openmindedness	Appearance	Competitiveness	Sense of humor
1	12	4	12	4	6	0	1	0	2	0	0	0	0	1
2	4	6	4	8	6	5	4	1	1	1	1	1	0	0
3	8	8	4	7	5	2	3	1	2	0	2	0	0	0
4	9	6	4	2	3	9	2	4	1	0	1	1	0	0
5	1	5	1	7	8	8	4	2	1	0	2	2	1	0
6	3	4	1	3	5	6	7	3	3	0	2	4	2	0
7	2	4	5	1	2	2	5	5	6	2	2	4	2	0
8	1	2	6	5	2	4	2	2	3	3	5	4	3	0
9	0	2	2	2	0	3	3	8	3	1	5	4	8	1
10	1	1	3	1	0	0	2	7	4	4	5	3	7	3
11	1	0	0	1	3	3	1	2	7	7	4	3	8	2
12	0	0	0	0	0	0	4	4	3	7	9	10	2	4
13	0	0	0	0	2	0	3	2	4	13	3	6	4	5
14	0	0	0	1	0	0	1	1	2	4	1	0	5	26
Sum of positions	146	185.	190	202	204	234	298	350	363	365	388	397	431	539
Range	1-11	1-10	1-10	1-14	1-13	2-11	1-14	2-14	1-14	2-14	2-14	2-13	5-14	1-14

structors at the fourteen officers' training camps. The results of their ratings of the fourteen qualities are given in Table 2.

The same seven qualities appear in the first half, as in Table 1, but in a different order. Integrity, initiative, and perseverance are given more importance and health, aggressiveness, and organizing ability less. This shifting is probably due in part to individual differences rather than group differences. At first glance health seems to have been distorted in place, but further examination shows that 82% of the candidates and 80% of the officers put it in one of the first seven places—in other words, no marked group difference is present. In the second half the most striking placement is that of refinement. It is three places higher in the officers' rankings, and yet only 7% of the officers placed it in one of the first seven positions and 15% of the candidates did—thus its new position is due in part to the officers' thinking openmindedness and competitiveness less important than the candidates did. A comparison of Tables 1 and 2 shows a scattering of opinion for both groups. The range is less for the officers' group, but in both tables it is large.

The following Table 3 gives the median position for each of the qualities and their average deviation from the median. When records are at hand for other occupations besides military, a comparison will be interesting.

TABLE 3

	42 officers		100 candidates	
	Median	A.D.	Median	A.D.
Aggressiveness	4	2.48	4	2.33
Appearance	10	2.36	10	3.01
Competitiveness	10	1.83	10	2.74
Control of emotions	9	2.28	8	2.71
Cooperativeness	9	2.88	9	2.80
Initiative	4	1.93	5	2.53
Integrity	4	2.81	6	3.42
Health	5	2.48	1.5	3.82
Judgment	3	1.81	3	1.79
Openmindedness	10	2.43	10	2.56
Organizing ability	6	2.85	6	2.93
Perseverance	5	1.90	6	2.23
Refinement	12	1.69	12	2.18
Sense of Humor	14	1.17	13	2.57

As a practical matter, the forty-two Regular Army officers probably have a much more definite idea of the desirable qualities to look for in a man who is likely to succeed in military life than have the one hundred civilians, but the present investigation fails to bring this out strikingly (1) because of its abstract nature, (2) because of the arbitrary selection and inexact definition of qualities, (3) because the same qualities are needed in many professions, and (4) because of the many possible interpretations of the phrase 'success in military life.' Very obviously success in different ranks and branches of service depends upon different qualities. A man capable of success as a private might never succeed as an officer, and similarly a man might gain immediate success as a lieutenant without possessing in sufficient degree the qualities necessary for ultimate success in the highest ranks. One lieutenant-colonel of the Regular Army placed the qualities in the following order, as being the best combination for a young lieutenant just starting his military career: Judgment, Openmindedness, Integrity, Perseverance, Aggressiveness, Initiative, Organizing Ability, Cooperativeness, Competitiveness, Control of Emotions, Health, Refinement, Appearance and Sense of Humor. A major to whom thousands of officers are indebted for their conception of the value of physical training places Health first, and the other qualities as follows: Integrity, Judgment, Organizing Ability, Initiative, Perseverance, Appearance, Aggressiveness, Cooperativeness, Competitiveness, Refinement, Control of Emotions, Openmindedness, and Sense of Humor. A Brigadier-General writes: "From the viewpoint purely of the soldier, it is not practicable to possess any of the other qualities to the desired degree, if one has poor health, as here defined. I am of course, somewhat uncertain as to the relative values to be placed on several, such as, for instance, initiative, organizing ability, judgment, aggressiveness, integrity and perseverance. They are all necessary to make the complete man, and yet I think, I have given them the relative value they should occupy." His order was: Health, Organizing Ability, Initiative, Judgment, Aggressiveness, Perseverance, Competitiveness, Integrity, Cooperativeness, Openmindedness, Appearance, Control of Emotions, Refinement, Sense of Humor.

Another officer states that the two most important qualities for an officer to possess do not appear on the list, namely leadership and ability to judge men. A fourth, a major, who has been nineteen years in service and is exceptionally well read in the lives of great military leaders, believes that very few of our Regular Army officers, much less those now hastily becoming officers, have seen enough actual warfare to adequately estimate the most important qualifications for successfully commanding troops in the field. He suggests that the best estimation could be found in the memoirs of the great generals of history who have written of the qualities that are necessary to lead troops in battle. This is a fruitful field, and the writers regret that their lack of acquaintance with it prevents the entering of information from these sources in the present article, which must be confined to the limited data at hand. It seems possible, however, that, were a list of character qualities, such as used here, presented for rating to any number of great military leaders, a similar wide range of opinion would be found, due partly to individual differences in interpretation of both the nature of the qualities and the requirements of varying military situations, and partly to individual differences of opinion. For example, Napoleon says, "The most important quality of the soldier is his ability to support fatigue and privation; physical courage is only the second." Yet battles have been won (Montcalm at Quebec) by leaders in ill-health who have gone from sick beds by force of will. Consequently we must expect to find different importance attached to health and to each of the other qualities according to the attitude and interpretation of the man ranking them. Furthermore, very much the same qualities are needed for success in any field of endeavor.[1]

An attempt was made to see if the results of these rankings could be utilized as criteria for the qualities to look for in the selection of desirable officers and non-commissioned officers. For example, would an individual who ranked the given list of qualities in an order widely different from that given by the average show any peculiar characteristics making him unlikely to succeed in military life? Correlations between the objective order and sixteen individual rankings by the candidates were worked out. The objective order was the order of the average orders of the one hundred candidates. It was found that orders given by some of the candidates who failed to be commissioned at Plattsburg correlated higher with the objective order than many of the orders given by men commissioned as captains and lieutenants. If the objective order is taken as a standard order, then a man's estimation as to the relative importance of these qualities seems to have little or no relation to his own possession of the qualities requisite for success.

The method for estimating abilities recently described by James Burt Miner of Carnegie Institute of Technology[2] was followed in the next part of this investigation. Cards for rating individual candidates were prepared. The qualities used on the card were the five of the previous list ranked highest by Regular Army officers and by the candidates, with the addition of the sixth, Leadership. The card was as follows:

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[1] H. L. Hollingworth. *Vocational Psychology*, pp. 98-99.

[2] James Burt Miner: The Evaluation of a Method for Finely Graduated Estimates of Abilities. *J. of Applied Psychol.*, 1917, Vol. 1, pp. 123-133.

Please rate the candidate named above for the traits indicated, keeping in mind employment in military service. Give the rating independently without consulting others.

Among the members of this company the candidate would rank in which fifth? Indicate the position in each trait by placing a dot along the line, grading the candidate as finely as you can.

	Lowest 5th	Fourth 5th	Middle 5th, Av.	Second 5th	Highest 5th
Judgment...........					
Initiative...........					
Aggressiveness.					
Health.............					
Integrity.					
Leadership..........					

Name the highest rank which you think this candidate has the ability to attain.

State the branch of service for which this candidate seems to be best qualified.

It was planned to have twenty-five men in one platoon rate each other and themselves for possession of these qualities as compared with the other members of their company, but, owing to lack of time, it was impossible to get all of these ratings made before the commissions were announced at the close of camp. However, nine men of one platoon filled out ninety-six of the cards and the results are summarized in Table 4. The ratings cover fifteen men but are fairly comparable since nine of the men were rated by at least eight of the same nine judges. The six men marked by asterisks (*) included themselves in the ratings. Their estimates of self were uniformly higher than the average of estimates given them by their judges. To simplify the scoring the divisions on card were numbered Highest 5th to Lowest 5th 1, 2, 3, 4, 5, and a dot appearing in a division credited with the number of that division. Thus a dot appearing in Highest 5th is scored 1, a dot in second 5th is scored 2, and so on. Hence the *smaller* the score after a man's name the more favorably he was rated. If eight men rated one candidate as being in Highest 5th in each quality, his score for each quality would be 8 and his total 6 x 8 or 48, or a 'perfect' score. To facilitate comparison, the difference between each man's possible total score and his actual total score is given; but strictly these differences are comparable only where the judges are identical and equal in number. The sections of the table to the right tabulate the answers to the request on the cards, *i.e.*, Name the highest rank which you think this candidate has the ability to attain; State the branch of service for which this candidate seems to be best qualified. The last section also shows the actual commission received at the close of camp.

Apparently for the few men covered here the ratings by these judges correspond pretty well with the selections made by the authorities at the camp on the basis of the candidates' records and the recommendations of Regular Army officers who judged the men and who observed especially their aptitude, conduct, capacity for command, military bearing, zeal, physical fitness. The impression of the writer with military experience is that usually such abstraction and refinement in rating men would be both impracticable and superfluous for the selection of non-commissioned officers in the company. Its chief advantage would be its fairness to the men and the minimizing of the partialities of those making the selections; but the company commander should deal fairly with his men, and the rough and ready tests of camp life, the drill field and the actual military situations furnish him the best basis for selection.

Although it is possible that any 'paper' test given in a few minutes will not serve to differentiate in a reliable way desirable men for leaders and responsible positions, especially in the varied requirements of military life, yet some of the standard tests do show important individual differences. The Woodworth-Wells Hard Directions test is one which has not been found to correlate very highly with scholarship, and yet it might show a certain sort of 'ability to keep one's wits' that seems necessary in military life. This test was given to twenty-eight candidates at Plattsburg. The results are shown in Table 5. The average time was 2 minutes 16.7 seconds and the average number of errors 2.4.

Apparently the test does not correlate well with that combination of abilities which make for success in military life, at least not on th[illegible]f the selections of these men made

TABLE 4

Rating	Candidate	No. of judges	Score by qualities						Aggregate score			Highest rank able to attain								Branch		Commission
			Judgment	Initiative	Aggressiveness	Health	Integrity	Leadership	Total score	Possible score	Difference	N. C. O.	2nd Lieut.	1st Lieut.	Captain	Major	Lieut. Colonel	Colonel	General	Line	Staff	Commission received
1	We. . . .	4	5	5	5	7	4	5	31	24	7							1	3	4		Capt.
2	Rn.	3	6	6	4	5	4	4	29	18	11					3				3		Capt.
3	As.	3	4	5	10	7	3	6	35	18	17				1	2				1	2	2nd Lt.
4	Kf.	3	10	7	6	9	13	9	54	18	36		2		1					3		2nd Lt.
5	Mn.* . .	8	19	14	11	12	20	16	92	48	44				1	3		3	1*	8*		2nd Lt.
6	Ky. . . .	8	19	17	16	15	13	18	98	48	50					4	4			5	3	Capt. Ord.
7	Lg.	7	17	16	21	14	11	17	96	42	54				4	2	1			7		Aviation
8	Sn.*. . .	8	19	22	23	16	11	21	112	48	64			2	4*	2				8*		Aviation
9	Pk.	4	17	16	15	10	15	16	89	24	65	2	1		1					4		None
10	Pn.	8	19	25	30	15	12	25	126	48	78			3	3	2				5	3	2nd Lt.
11	Hd.*. . .	8	21	25	30	17	16	24	133	48	85		1	1	3	3*				6	2*	None
12	Dr.*. . .	8	26	26	26	25	22	29	154	48	106	2	1	1	3	1*				5*	3	None
13	Hw.* . .	8	24	26	29	28	19	36	162	48	114	1	2	2	2			1*		5*	3	2nd Lt.
14	Me. . . .	8	30	30	29	20	24	32	165	48	117	2	6							8		None
15	Hr.*. . .	8	28	30	31	24	24	36	173	48	125	2	3	2	1*					5	3*	None

* Self-estimated.

hension are those of an infant. Of course he obviously needs institutional care.

This description does not apply to the moron. Technically he has a mind which ranges from that of an eight-year-old child up to that indefinable level which just renders him deficient enough to fall below the level of those who have made good and reached normality. Actually he is different from any child after he has passed the years of his own childhood. His mind, however inferior, has had the extra ten or fifteen years which have brought him to adulthood. In that time he has gathered experience and his mind is that of an eight- or ten- or twelve-year-old *plus* adult length of experience. His reactions are necessarily different from those of a child of the same inherent mentality because of this factor of experience.

This moron group are as healthy and strong of body as the average man or woman we meet on the street. They have good co-ordination. They are athletic and physically capable. They are not often detected and placed in institutions because of physical inferiority but because of either social, moral, economic or educational difficulties. It is from these standpoints therefore that he is most apt to be a problem if he is introduced to army life.

Socially he is not likely to become a problem unless he becomes a prey to more clever men who induce him to voice their discontent or who torment him until he becomes sullen. Usually he is willing, easily interested, affable and eager to be friendly with everybody.

Morally he is apt to be a problem. He tends to be sexually promiscuous. But when we consider the enormous problem which prostitution and venereal disease raise the minute an army gathers, we doubt whether the moron is any worse in this respect than the average man, except that the moron gets caught. The same is true in regard to crime. The moron is not a born criminal. He seldom thinks up the crime for himself. He gets caught more frequently. Nor has it ever been proven that he is more given to lying or that his lying is any more chronic or malicious than that of supposedly normal people.

It is not a bad thing to know a soldier's short-comings, and one surely cannot discard the moron from our armies because of probable social or moral defects in which he is no worse than other recruits. The reason for his use or elimination must consequently be sought in his tendency to be an economic and educational failure. These two aspects of failure are really indications of the same thing. The economic efficiency of the child lies in his being the best sort of a student possible and so using to the best advantage the opportunities for work which are opened to him. When he is through school his utilization of his chances for earning his living continues the demands made upon him. His success in both situations depends upon his learning and adapting to the situation which confronts him. The question of the moron's making good in the army or navy consequently depends upon whether he can learn what is required of him as a military unit and whether he can adapt to the daily regime.

So far as formal psychological tests go we find that the moron can learn. He is, on the average, slower in learning than the normal person and slower in adapting when the thing to be learned and adapted to is an abstract thing. But put him in a concrete situation, give him a concrete thing to learn, and there is little difference between him and a normal person. In concrete situations the defective does his best. He glories in the actual thing to be done. He can learn to drill and march, to dig, drive teams, and build. He can fetch and carry and he does it with a better will than the normal man who dreams of accomplishing more than a trivial round of chores which is never done.

The moron fits into the cogs of a big system with very little friction. He is content to eat and sleep and dress and work as a part of a machine with machine-like regularity. Such monotony he can understand and appreciate.

He does not adapt rapidly to changes which he must meet without any help from superiors. He does not have mental activity enough to attempt his own personal variation of a task which he has been taught to do in a certain fashion. He is not apt to become insubordinate unless asked to do tasks entirely too difficult for his ability. He does not worry about the future. His lack of ability to foresee and plan for the future makes him less able to imagine vividly the dangers confronting him to-morrow or next week. He is, consequently, less apt to be a prey to fear. He is content with simple amusements. He likes having a little money to spend, a good meal, a few hours off duty. He is satisfied with a minimum amount of comforts. He will do the thing he has been trained to do with stupid persistence in the face of certain death. All of these attributes seem to indicate a possibility of using the moron in the emergency we face to-day.

A present tendency is to eliminate all mental defectives, the moron included, from actual war service. This seems irrational from several standpoints.

We do not know that the mental defective will not make a good soldier. His very stupidity makes him easily led with the group of which he is a part and there is much work to be done where numbers are as important a factor as any other. The defective probably could never be made a first-line man where the intricacies of modern warfare demand so much and such varied intelligence. He surely would do well in a "shock" regiment, however, and he could do a tremendous amount of drudgery in the camp behind the firing line. For such places as these every moron eliminated means the waste of a normal man.

But there is a far wider significance than this. The normal man goes to war, the man of low intelligence is left at home. The next generation bears the loss of the former plus the burden of the latter *and his children*. Not that defectives should be indiscriminately mixed with other men. They should be known through careful examination and then segregated. Even if not sent abroad as a whole they might be made most effective under governmental direction in this country.

The detection of morons, except perhaps the lowest ten per cent, will be by no means easy. No one criterion justifies a man's elimination unless he be markedly abnormal, and the moron is not markedly inferior in any way. A mental test alone may be theoretically correct as a means of eliminating the unfit, but we so far have no proof that there is a high correlation between ability on mental tests and ability as a man of war.

The final decision as to the use of the moron, whatever it may be, will affect the present far less than it will future generations. All issues in the struggle for the survival of the fittest will have to be fought anew under the handicaps the present war has forged. Whether we can handle the problem of the moron wisely and yet not throw further burdens on future generations remains to be seen.

A TEST FOR MEMORY OF NAMES AND FACES

RUSSELL L. GOULD, Carnegie Institute of Technology, Pittsburgh, Pa.

Socially as well as in business the ability to remember the names and faces of people previously met is very desirable and is sometimes absolutely necessary. The growth of practically every sales organization depends largely on repeated orders from customers who have become attached to the house through the personality of a salesman. A salesman cannot make a good impression without being able to call his customer by name, and while in making routine calls he may use a memorandum to refresh his memory on any customer whom he is about to see, such a preliminary opportunity for "coaching" is not always afforded. The customer may be met unexpectedly on a train or on the street, and an immediate introduction to a third person would require that the name be recalled at once.

No further argument is necessary to emphasize the importance of the matter and this report will present an attempt which has been made to find a means for discovering the existence of the ability in question.

The test proper consists of 100 men's pictures, approximately two inches square, clipped from a college annual, and pasted in rows on a large sheet of paper. The pictures are numbered consecutively from 1 to 100. Duplicates of 20 of these pictures are pasted on a card of smaller size. Under each of these 20 pictures is typed one of twenty common names. No first names are used, nor are any pictures of women used. The subject is instructed as follows:

"You will be shown the pictures of 20 men for five minutes. Each man's name is under his picture. At the end of five minutes you will be shown the pictures of 100 men, among which are scattered the 20 which you saw just previously. You will be asked to recognize those 20 and to name as many of them as possible."

There is no time limit for the recognition of the faces and the recall of the names, and the subject is allowed to go over the pictures more than once. If a face is named differently at one time than at another, no comment is made and the last declaration is recorded. The subject is informed as to the number recognized and named, without regard to the number of errors.

In scoring, 5 points are allowed for each face correctly named and 1 point for each face correctly recognized and not named. This gives a possible maximum of 100 points. One point is deducted for each false recognition. In further work 20 recognitions will be allowed without penalty for errors. On the original basis the scores for 72 subjects varied between 10 and 92.

The first question is in regard to the reliability of the test, and to measure that it was repeated on 33 subjects after an interval of not less than one week. The subjects were psychologists and college students. In the second trial a different selection of 20 pictures was used, and with names different from the original. The Pearson correlation between the scores in the two trials was .78. In the second trial there was occasional evidence of greater confidence and other slight adaptation to the work so that the median rose from 37 in the first trial to 43 in the second. On the whole however, the performances were quite consistent with each other.

Compared to the work of some other experimenters, the relation between recognition and recall is here quite high, the Pearson coefficient for 50 cases between recognition and recall of names being .61. There is here of course a high degree of association between the two.

The next step is to discover what relation, if any, ability in the test bears to ability in actual life. Before each subject was tested he was asked to state his conception of his own ability to remember people whom he met. In three cases of exceptionally high known ability and in one case of exceptionally low ability, there was perfect agreement with the test. In most of the other cases modesty, or over-confidence in the natural manner of expression, or ignorance due to lack of attention to the matter reduced each statement to a level, which as an indication of ability was without significance. In about 90% of the cases the answer was: "I'm not very good at remembering people's names; I can remember their faces much better."

To get a measure of ability in actual practice ten members of the psychology department of the Carnegie Institute of Technology who had taken the test were introduced under experimental conditions to seventeen students who were strangers to them. The attempt was made to have conditions as nearly as possible duplicate an actual situation,—as for instance a reception. The strangers (students) were given arbitrary names, selected for frequency in ordinary life. The ten psychologists stood in line. A stranger was introduced to the person at the head of the line, and they engaged in the ordinary form of pleasant conversation. At the end of one minute psychologist number 1 introduced the man talking to him to psychologist number 2, and then the second stranger was presented to number 1. This was continued at one minute intervals until all the students had been introduced. As soon as a student completed his one minute with the last psychologist he passed out of sight into an adjoining room. When all the students had been through this process a visible number was pinned on the coat of each, the psychologists provided with paper, and the two groups thrown together. The psychologists re-engaged the students in light conversation and endeavored to recall the names and enter them, numbered, on the paper which they carried. A very cordial spirit of experimental honesty naturally was maintained by the psychologists. As much cannot be said for the students who were asked to go through the corresponding performance of recalling the names of the psychologists. In view of the fact that they failed to observe the proper spirit their records were discarded.. The records of the psychologists are as follows:

	Rank in Test			Rank with People
	1st trial	2nd trial	Combined	
A	1	3	1	1.5
B	2	2	2	1.5
C	3	4	3	3
D	4	8	6	6
E	5	5	5	9
F	6	1	4	7
G	7	7	7	4
H	8	9	9	8
I	9	6	8	5
J	10	10	10	10

There is of course a very considerable difference between associating names with pictures, and meeting a number of strangers and keeping their names in mind. The social factor in the latter case is very prominent and if a person is so constituted that the temporary balance of the mental factors involved is slightly disturbed thereby, then his memory for names will be comparatively much less effective than his memory under different circumstances. Such a change is noticed in subjects E and F, who drop from ranks 5 and 4 with the pictures to 9 and 7 with the people. Personal acquaintance with the subjects gives the explanation suggested above, as it does also the rise in rank of subjects G and I, G and I might be considered rather social than studious, while E and F are just the opposite.

The agreement between the test rank and the rank with people is comparatively close, especially with the extremes. In fact it is almost too close. It is not sufficiently clear that the situation with the seventeen strange students gave a positive indication of the abilities of the psychologists, although their rank positions were approximately as each had anticipated. Further tests of the same kind are highly desirable.

A second method, and the ultimate one, for checking the test if it is to be used for selecting men for business positions, is to give it to people who have well recognized ability for remembering names and faces, and whose positions actually require it,—such as hotel clerks, office window tellers, etc. A very important difficulty of the test became apparent when it was given to a number of such people. Brief, intense study of something unusual, such as the test required, is absolutely foreign to their habits. They had all been out of school for a considerable number of years and were rather lost for a method of procedure. Artificial associations were not easily formed. In the ordinary course of their work most of the people with whom they deal are conspicuous for some particular phase of their business. There are a number of helps for placing each man. This suggested that in the twenty stimulus pictures of the test it is not enough to have simply the men's last names. Accordingly, without changing the requirements above recalling the last name only, each picture has been given a full name, the man's occupation and place of business, and the town in which he lives, as:

Fred W. Hamilton, reporter, *Evening Sun*, Buffalo, N. Y. This method has not been tried out sufficiently to show what the results will be.

To use the test exclusively on prospective insurance salesmen it has been suggested to insert the kind of data that is most important for an agent to know when he meets a prospect; such things as age, marital condition and dependents, and occupation. A similar practice could be followed with other specialized groups.

A change in the technique has been adopted tentatively to relieve the recall of the names from dependence on previous recognition of the faces. After the twenty pictures are shown with the names, etc., the same twenty pictures only are presented, but in different arrangement, each numbered. This gives a score for the recall of names. Then for the recognition of faces those same twenty are to be identified, without naming, in a group of 100. For the present at least further study should be made on recognition at the same time as the work on recall, although later the recognition may be dropped in order to simplify the test.

MENTAL TESTS OF UNEMPLOYED MEN

By Rudolf Pintner and Herbert A. Toops, Ohio State University

Part I

The question of unemployment is one of our most serious economic and social questions. It affects not only the men that are out of employment, but indirectly society at large. Up to the present time, however, it has been treated almost entirely as an economic or social problem, and the psychological characteristics of the men who are unemployed have been scarcely dwelt upon.

The history of unemployment shows the earlier economists treating the problem with no regard to the variability of the human factor in the situation. Gradually some realization of the significance of this factor is forced upon them, but mainly from the standpoint of the efficiency of the individual, and the efficiency of the individual is even then looked upon as almost, if not entirely, dependent upon the education or the opportunity for progress that he may have. Only recently have the psychologists emphasized the importance of the mental make-up of the individual in reference to his fitness or unfitness for a place in the industrial system. As Münsterberg[1] says, "The individual needs the place for which his mental dispositions make him fit, and the work demands the individual whose abilities secure his success." Alongside of these endeavors on the part of vocational psychology to find the right man for the right place, there is evident a growing realisation of the importance of the general intelligence of the individual. This point of view is well represented in the words of Hollingworth;[2] "The first definite contribution of vocational psychology is thus not so much toward the guidance of the individual worker as for the guidance of the employer who may be required to select from a number of applicants those whose general intellectual equipment is most adequate. But we shall later have occasion to point out a further contribution which this makes possible, in so far as it may enable us to classify the operations involved in various types of work and to align these operations and tasks along the general intelligence scale." The intelligence of the individual is not the only factor in the complex problem of unemployment, but it is one of the important factors, and it is with this factor alone that the present investigation deals.

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[1] Münsterberg, H. *Psychology, General and Applied.* 1914. p. 415.

[2] Hollingworth, H. L. *Vocational Psychology.* 1916. p. 79.

Columbus, Ohio, Free Employment Office

The industrial conditions in Columbus during the time of this investigation, October 10th, 1916—March 10th, 1917, were good, in fact, no competent man willing to work had need to remain long out of employment. Owing to the war living expenses were steadily rising which had the effect of making it more necessary than in past years that each man strive to remain in steady employment if he were to secure the common necessities of life. The winter was not particularly severe, and this allowed much construction and street work to be done during the winter months. During this same winter there was an unprecedented influx of negroes from the South who were attracted by the high wages prevailing in the North. It became the duty of the employment office to place most of these colored men in positions. Nearly all were, of course, common laborers; a few were house servants, while a still smaller number were skilled workers of some sort. Considering the applicants as a whole, we believe that this period of investigation may be considered fairly representative of the normal class of applicants with which the office has to deal.

Inasmuch as no published report of any similar investigation had appeared, the methods to be used had to be devised, and even the purpose of the investigation had to be modified as the results of experimentation showed to be necessary, in order to adapt it to the ordinary routine of the office procedure and the limitations and characteristics of the men themselves. Three main lines of invesigation gradually emerged: (1) to determine the mentality of the applicants as a group; (2) to determine the mentality of the four industrial classes into which the group could be readily divided; and (3) to determine the relation of mentality to industrial, social, or educational factors. It thus became necessary first of all to collect, in the brief time allotted, as many industrial, social and educational facts as possible concerning each man, and then to determine his mentality.

The men selected for examination were chosen so as to be, as far as possible, representative of the whole group of applicants. This was necessary since it was impossible to test more than three to five per cent of the applicants applying during the time of the investigation. In order to test representative cases, samples from the various classes in the ratio of the numbers in these classes were tested. The group was divided into three simple groups, native-born whites, colored, and foreigners. In order to determine the relative proportions of these three groups, a tabulation from the registration cards in the office was made of all new applicants registering during the period of May 27, 1916 to November 27, 1916, which also showed the number of cases in each of these three classes by age groups for a period of six months. Of the 3927 registrations during this period 10.4 per cent or 408 registrations were not included due to lack of information about them. The distribution of the 3519 remaining cases shows that the proportions of the three classes are roughly as follows: 1 foreigner: 5 colored: 11 native whites. The ratio of our samples, then, should be in about this proportion. However, since the foreigners formed only 5.7 per cent of the total and were disributed among at least thirty different nationalities and, moreover, were handicapped by difficulties with the English language, it was decided, after testing a few of them, to disregard the group entirely. Their exclusion would have little or no effect on the total results and their inclusion would lead to many difficulties in mental testing which it is well to avoid. The foreigner does not constitute an industrial problem as far as this employment office is concerned.

Table I shows the percentage of white and colored men in each age group. This table will be used later in deciding whether or not the men selected for the tests are representative of all applicants as to age. Another tabulation of the

TABLE I

PERCENTAGE OF WHITES AND COLORED BY AGE GROUPS. MAY-NOV., 1916. COLUMBUS, OHIO, FREE EMPLOYMENT OFFICE.

	Per cent	
Age	Native whites	Colored
Under 20	12.3	8.3
20-29	43.0	61.9
30-39	23.2	21.1
40-49	13.5	6.6
50-59	5.4	1.7
60-69	2.2	0.4
70-79	0.1	0.0
80-89	0.1	0.0
Total	99.8	100.0

grade at which all applicants left school when compared with the report of the selected applicants will give us another check on the reliability of our selection. Again, one should examine as large a group as possible in order to get an accurate distribution. And finally, one may decide whether or not enough cases have been examined by re-calculating the median each time a new group of cases has been added. If a point is reached where the median is not changed by the inclusion of additional data, then in all probability the number of cases is sufficient. The cases for examination, then, were chosen at random roughly in the proportion of five negroes for every eleven native-born whites and without consideration of age, education, and other characteristics. We may reasonably expect these to distribute themselves normally if we take our cases in the proportions given above.

Each man selected for examination was first questioned as fully as the time and his willingness to cooperate would allow in regard to himself, his work, past career and future hopes. An outline form was used in order to secure uniform information in regard to all men tested. The outline was not strictly adhered to, but used mainly as a means for securing definiteness and uniformity in the questioning. The data regarding name, registration number, age, color, birthplace, marital condition, grade at leaving school, occupation and best job were secured for practically every person examined. In addition, the industrial class to which each man was assigned, was decided by reference to his account of his past career and by conference with the superintendent of the office. In the same way any other information given by the persons examined was checked up and augmented, wherever possible, by conference with the superintendent or clerks in the office. The data collected are, we believe, for the most part accurate, as the examiner tried to have the subject fully understand that misleading or untrue statements would not be to his advantage in any way. Arguments similar to the following were frequently used to secure this result: "I have asked you to come in here in order that I may find out more about you. The office wants to know more about the men who apply for work. These questions may never do you any good at all, but sometime they may aid the young fellows who are just starting out to work. So if you are willing to help some other fellow who will want a job at some future time I shall be glad to get the facts concerning you and your work." Only two men refused to take the tests, and only one refused to complete the tests after beginning them.

The selection of tests to be used was dependent upon several considerations:

(1) They should not take much time to give. From half to three-quarters of an hour was as long as could be given to the test, including the preliminary questions.

(2) They should be tests which the men would regard as appropriate. Since the applicants were all adult men they were apt to resent being subjected to some of the childish tests of the Yerkes or Binet Scales. A test should thus be one which shows "how quickly you are able to do this." The tests should suggest nothing in the way of a mental examination, as these persons are very suspicious of anything of this sort. They do not see any distinction between a mental and a psychiatrical examination.

(3) The tests should each be short enough and have enough intrinsic interest so that the subject will keep his attention upon the work until the end of the examination. The men were not paid, so that this incentive to continued interest was lacking. This ability to keep his attention upon a task, often quite difficult, through motives other than those likely to result in monetary gain to himself, is in itself a good test of the individual's industrial worth.

After preliminary experimentation six tests were selected as best fulfilling these three requirements: the Cancellation Test, the Easy Directions Test—B, the Hard Directions Test, the Digit-Symbol Test, the Opposites Test, and the Cube Test.

The Cancellation Test is the A cancellation test.[3] The directions were simple: "I want to see how fast you can work. Take your pencil and see how many A's you can mark out, like this (illustrating the motion for the first two or three A's). Ready, go." The subject was allowed to work for one minute.

The Easy Directions Test[4] was ordinarily given next. The directions were: "Fill this blank out according to directions. Do exactly what each line tells you to do. I want to see if you can fill out the blank correctly. Take all the time you want and try to fill it out correctly." The test was thus given without a time limit. If the subject made a creditable performance on this, showing ability to read as well as to understand, he was handed the next test.

The Hard Directions Test[5] was begun by telling the subject to "do exactly with this as you did with the other. Fill it out according to directions." If the subject showed by these tests inability to read, he was generally tested by the Yerkes-Bridges Scale.

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[3] Whipple, G. M. *Manual of Mental and Physical Tests*, p. 307.

[4] Woodworth, R. S. and Wells, F. L. Association Tests. *Psychol. Monog.* No. 57. 1911.

[5] Woodworth and Wells, *op. cit.*

In the Digit-Symbol Test five minutes were allowed. The subject was made to understand the procedure before beginning the test by being allowed to fill in several sample lines. This test after experimentation was adopted in preference to the Symbol-Digit Test.

In the Easy Opposites Test one minute was allowed. The procedure was illustrated by the words "long, soft, up" and others if necessary. The subjects were told to "write as fast as you can, and if you come to a word whose opposite you cannot think of, let it go till the last so as to be able to get as many words as you can in one minute."

The Cube Test was given in the manner standarized by Pintner.[6] It was found that there was great variability in the performance of this test so that the subject was credited with the highest mental age to which his performance would entitle him on whichever of the two methods of calculating would give the higher mental age.

The directions and explanations were made as simple as possible. The test conditions were more favorable to our subjects than to the school children, whose norms are used to evaluate the results, since the children did not have the benefit of individual explanation or preliminary practice in any instance.

All blanks were scored by the standard method of scoring. The score in the Cancellation Test was the number of A's cancelled in one minute; in the Easy and Hard Directions Tests the number of directions correctly filled out according to the method standardized by Pintner and Toops:[7] the score on the Digit-Symbol test was the number of squares correctly filled out per minute, and for the Easy Opposites, the number of correct opposites written.

The several scores of each man were then turned into mental ages by comparison of the scores with the norms for school children obtained by Pintner.[8] The scores were turned into mental ages rather than percentiles, because of the lack of adequate adult norms. Percentiles would undoubtedly be better if adequate norms were available. The median of the several mental ages gives a mental index for the individual. These results were recorded on a card as shown here:

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[6] Pintner, R. The Standardization of Knox's Cube Test. *Psychol. Rev.,* Vol. XXII. 1915. pp. 377-401.

[7] Pintner, R. and Toops, H. A. A Revised Directions Test. *J. of Ed. Psych.* To appear shortly.

[8] Pintner, R. *The Mental Survey.* To appear shortly.

	1827	
John Doe	52 W.	U'ble.
	Score	M. A.
Cancell.	23	7.0
E. Dir.	12	8.5
H. Dir.	4	—8
D-S.	6.6	7.9
Opp.	5	8.5
Cube	—	—
Yerkes	—	—
Median		7.9

This is to be interpreted as follows: John Doe, whose registration number is 1827, is 52 years old, native-born white and belongs to the "unemployable" industrial class. He made a score of 23 on the Cancellation Test which credits him with a mental age of 7.0; on the Easy Directions Test he made a score of 12 which is approximately midway between the norms for 8 and 9 year old children, thus giving him a mental age of 8.5 on this test. The other tests are evaluated in like manner. The median mental age for the five tests is 7.9, which is the mental index for this individual. The median of the mental indices of any class gives the mental index for the class.

Results of the Tests

There were 94 men tested, classified according to color and nativity as follows: 50 native-born whites, 36 colored, and 8 foreigners. Six were tested on both the Yerkes and the other tests. Three were tested on the Yerkes Scale alone. Ninety-one were tested on the other tests alone. Not all of the 91 were tested on all the six tests. The number of tests used in testing any one individual depended upon individual circumstances. This, of course, makes some of the mental indices more reliable than others, since the greater number of tests used, the greater the likelihood of the index being the true index of the individual's ability.

In order to test the reliability of our sampling, the mental indices for the whites, colored, foreigners, and total were calculated after the 60th, 74th, and 91st cases respectively. These median mental ages are as follows:

	60th.	74th.	91st.
Whites	10.3	10.6	10.6
Colored	9.6	9.7	9.65
Foreign	11.0	11.0	11.0
Total	10.05	10.35	10.2

The very slight changes caused by the cases added to the original group suggests that the sampling is fairly representative of the group as a whole and is not likely to be materially changed by the inclusion of more cases.

TABLE II

DISTRIBUTION, IN NUMBERS AND PER CENT, OF MENTAL AGES OF WHITES AND COLORED, BY MENTAL AGE-GROUPS

	Number			Per cent		
M.A.	White	Colored	Total	White	Colored	Total
6	2	1	3	4.08	2.94	3.61
7	1	1	2	2.04	2.94	2.41
8	10	12	22	20.41	35.29	26.51
9	7	4	11	14.28	11.76	13.25
10	8	5	13	16.33	14.71	15.67
11	7	2	9	14.28	5.88	10.84
12	6	6	12	12.25	17.65	14.46
13	1	2	3	2.04	5.88	3.61
14	1	..	1	2.04	.....	1.20
15	..	..	..	.....	.....	.....
16	2	1	3	4.08	2.94	3.61
16+	4	..	4	8.16	.....	4.82
Total	49	34	83	99.99	100.00	99.99

Table II shows the mental ages arranged into mental-age groups. In making up this table fractions are disregarded; thus M. A. 10 will include all cases having a mental age from 10.0 to 10.9 inclusive. This table includes only native-whites and colored who were tested by the group tests alone.

The distribution in the two classes, native-whites and colored, would seem to indicate that each class is possibly made up of three fairly distinct grades of mentality, a relatively poor group, an average group and a relatively good group. The colored seem to have a smaller percentage in each of the higher groups than the whites and a larger percentage in the lowest group. Data in regard to the industrial classes to which the men belong would seem to corroborate this belief in three grades of mentality, although this is not so apparent in the case of the colored as in the case of the whites, the explanation being that, on account of his race, a negro rarely ever rises to a position above that of a laborer.

Diagnosis

Results of the tests given to individuals who have also been tested on the Yerkes Point-Scale seem to indicate that the selected tests yield lower mental ages than the Yerkes Scale. The dividing lines between feebleminded and backward, backward and normal, etc., should therefore probably be lower than in the case of the Point-Scale. The division lines for these tests arbitrarily adopted by us[0] are as follows:

	Mental Age
Feebleminded	— — 8.9
Borderline	9.0 — 10.9
Backward	11.0 — 12.9
Normal	13.0 — 16.0
Bright	16.0 — +

All those cases that had been tested on the Point-Scale were diagnosed on the basis of that scale as the more reliable measure of their mentality. There were nine of these cases, leaving 85 who were tested only on the other tests. These nine cases were diagnosed as a result of a consideration of both the C. M. A. and the Three Per Cent Hypothesis.[10] The 85 remaining cases were diagnosed on the basis of the division lines given above. All 94 cases were then combined, using that diagnosis in each individual case which was best, i.e., based on the Point-Scale wherever that was used. The diagnosis of our entire group is shown in Table III.

TABLE III

DIAGNOSIS OF THE ENTIRE GROUP BY THE BEST MENTAL AGE OBTAINABLE

	Number				Per Cent			
Diagnosis	Total	White	Col'd	For'n	Total	White	Col'd	For'n
F.M.	27	12	14	1	28.7	24.0	38.9	12.5
Border line.	28	15	11	2	29.8	30.0	30.6	25.0
Backward	27	15	8	4	28.7	30.0	22.2	50.0
Normal	8	4	3	1	8.5	8.0	8.3	12.5
Bright	4	4	..	..	4.3	8.0	....	....
Total	94	50	36	8	100.0	100.0	100.0	100.0

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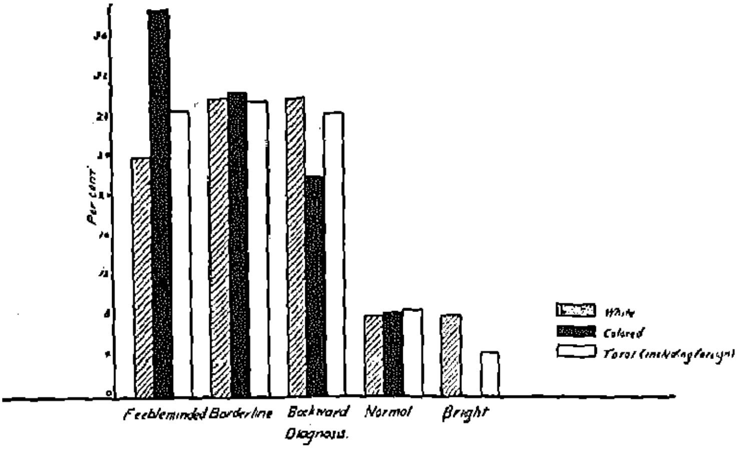
[0] Pintner, R. and Toops, H. A. A Mental Survey of a Workhouse. *J. of Delinquency*, Vol. 2, No. 5, 1917, pp. 278-287.

[10] Pintner, R. and Paterson, D. G. A Psychological Basis for the Diagnosis of Feeblemindedness. *J. of Criminal Law and Criminology*, Vol. VII, 1916, pp. 32-55.

The percentage distribution of these cases by color and nativity groups as well as the total distribution are shown in Graph I. We note the greater proportion of feeblemindedness among the colored than among the white. The colored have no representative in the bright group.

GRAPH I. PERCENTAGE DISTRIBUTION OF CASES ACCORDING TO MENTALITY GROUPS. COLUMBUS, O.



Mentality and Industrial Class

The relation of mentality to the industrial class to which an individual belongs was studied. This part of the investigation throws much light upon the question: what sort of an industrial career may we expect of individuals with different degrees of mentality under conditions prevailing at present?

Our 94 cases may be divided into four industrial classes which are fairly distinct and well defined. The basis for the classification is the length of time an individual is habitually employed. The classification is thus an arbitrary one and the data for determining to which class an individual belonged had to be collected by questioning the applicant, confirmed in many cases by the judgment of the superintendent of the office. The four classes with a definition of each are as follows:

(1) The Unemployed: men who habitually work on permanent or steady jobs but who, for the time being, happen to be out of work.

(2) Casuals: men who habitually work only long enough to get sufficient money to tide them over until it again becomes

necessary to work in order to maintain a mere existence. Hoboes, vagabonds, and others are included in this class.

(3) Odd Jobs: men who work fairly steadily upon short time jobs. Day work is the most common occupation of this class.

(4) Unemployables: men who are on the lowest verge of the margin of industry, men who never get a job unless there is great demand and unless there are no better men willing to take their places. Many of this class depend mostly or wholly upon charity for their support.

The first four lines of Table IV show the distribution of our 94 cases by industrial groups and by color and nativity. This distribution should be regarded as suggestive rather than fully indicative of actual conditions. It is undoubtedly true that individuals are misplaced in this classification, some too high and some too low. The large number of colored unemployed is due to the fact that colored men have not as many different jobs open to them as the whites, and consequently it is rather the normal thing often to work at jobs which, in the case of the whites, would be classified as odd jobs. We should expect the total group to be divided proportionately as it is; the largest number falling into the unemployed group, followed by the odd jobs men, who most nearly resemble the first class, at least from the view of desirability as employees. The casuals are unreliable, owing to their temperamental difficulties, they easily get jobs which they soon leave, as a rule to go to some other job or some other city, often even at a lower wage than in the previous position.

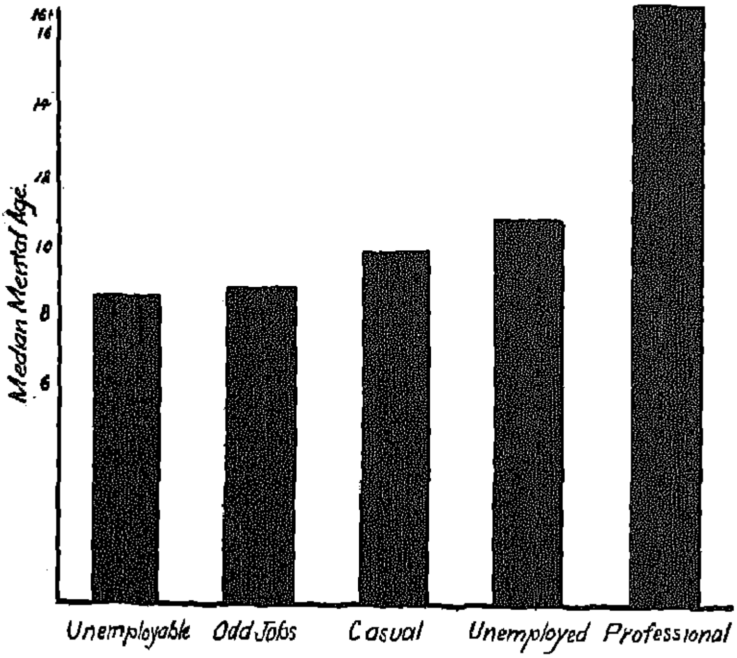
TABLE IV

DISTRIBUTION OF CASES BY COLOR AND NATIVITY, AND BY MENTALITY

	Total number	Unemployed	Casual	Odd jobs	Unemployable
White	50	32	6	7	5
Colored	36	30	1	4	1
Foreign	8	6	1	1	..
Total	94	68	8	12	6
Med. M.A.	10.55	10.9	10.0	9.0	8.7
Range of M.A's.	6.0–16+	8.2–16+	8.0–13.9	8.0–16+	6.0–10.0
Feeble-minded	27	15	2	6	4
Border line	28	20	3	3	2
Backward	27	24	1	2	..
Normal	8	6	2	..	..
Bright	4	3	..	1	..

The median mental age and range of mental age of the cases is shown in the next two lines of the table. Graph II shows pictorially the relation of mental age to industrial class. For purposes of contrast a group of four professional men, tested with the same tests, is also shown.

GRAPH II. MEDIAN MENTAL AGE OF THE FOUR INDUSTRIAL CLASSES, COLUMBUS, O.



The last five lines of the table give the mental diagnosis of these 94 cases by industrial class. The results show that no one mental level is monopolized by any industrial class. The unemployed have representatives in every group, although this class has distinctly more individuals in the higher mentality groups than any other industrial class. As we shall later point out, even feeblemindedness is not necessarily inconsistent with steadiness and reliability in work. The casuals rank next to the unemployed, and we have already noted that temperamental difficulty rather than feeblemindedness is responsible for their position in the industrial world. Perhaps the mental backwardness of this class allows the bad temperamental make-up a more fertile field for bad symptoms to appear than in the case of persons of normal mentality similarly afflicted, who have inhibitions against the conduct so characteristic of the casual worker. The groups of odd job and unemployable men seem to be characterized by low grades of mentality. That other factors frequently enter is shown by the one case of a bright man, who on account of bad health belongs to the odd job class. In the case of the unemployables physical handicaps and bad health are common. These may be to some extent a logical result of mental defect in that these individuals have not enough good common sense to avoid accident or to take proper care of their health.

Mentality and Age

The distribution of mental ages by chronological age groups is shown in Table V. There is here no marked relation of age to mentality. The general decrease with age might suggest that the older applicants are men, who by reason of mental defect, coupled with physical infirmity, are no longer able to cope adequately with their economic environment. Another possible explanation is that these men, by reason of their mental and physical handicaps, have not been able to amass the means necessary to provide for old age. Consequently they are left in the daily struggle for bread at an age when many of their more fortunately endowed brothers are thinking of retiring from the industrial world and living comfortably on the wealth amassed during their more capable days.

TABLE V

MEDIAN MENTAL AGE BY CHRONOLOGICAL AGE GROUPS

Age class	No. of cases	Median mental age
Under 20	10	10.3
20-29	35	10.7
30-39	26	10.75
40-49	10	9.35
50-59	8	8.8
60 and over	3	8.9
Total	92	

Birthplace

Out of 43 native whites, for whom we have data, only 24 were born in Ohio; and out of 35 colored only 3 were born in

Ohio. The figures in the case of the native whites indicate the tendency of this class of people to move from place to place. Many were failures from the very start of their industrial career and have since moved about from place to place with the hope that some day they would find the end of the industrial rainbow with its "pot of gold" in the shape of a good job at big pay with little and easy work. This generally turns out to be merely a vision, for the individual can never escape from the defects of his mental handicap no matter where he may go.

Occupation

The occupations of 92 men were as follows: Labor 30; Daywork 14; Shopwork 7; Porter 6; Janitor 4; Carpenter 3; Miscellaneous 28. We note that labor, daywork and trades requiring only a limited amount of intelligence are the occupations of most of our men.

Best Position

The best job ever held for at least two weeks has been reported in 83 cases. This report, of course, was made by each man with no possibility of determining the reliability of the reports, which in some cases are doubtlessly exaggerated. We note, however, that few of the men examined have ever held positions of responsibility where a high degree of intelligence would seem to be essential. The median best weekly wage of 49 native whites was $22.50; the lowest best weekly wage any one individual had ever received in his life was $9.00, the highest $50.00. This latter statement was made by a man, a roller in a rolling mill, who tested feebleminded, and is doubtless unreliable, or, if true, at least very exceptional. The median best weekly wage of 34 colored men was $15, the lowest reported being $4.25 per week, and the highest $30.

Residence

Of 50 native whites, 16 or 32 per cent had, at the time of the investigation, lived in Columbus less than one year; seven others had not lived in Columbus over 5 years. The median length of residence was 9.0 years. This shows that the office serves a considerable portion of native whites who make their home in Columbus. In the case of the 35 colored, 24 or 65.7 per cent had been in Columbus less than one year. Only six had been in Columbus over five years and none over fifteen years. The median length of residence was four months, thus indicating that the colored applicants were largely recent arrivals in the city. One might easily imagine this influx of unskilled Southern negroes to be of lower intelligence than the Northern-born negroes, although we have no data to throw light upon this point.

Education

Table VI shows the distribution of 91 cases by the grade at leaving school. In most cases this "grade at leaving school" was the last grade completed in school. In some cases, however, the report is based upon the number of years the individual attended school; in still other cases the individual said he "guessed he must have quit" in such and such a grade.

TABLE VI

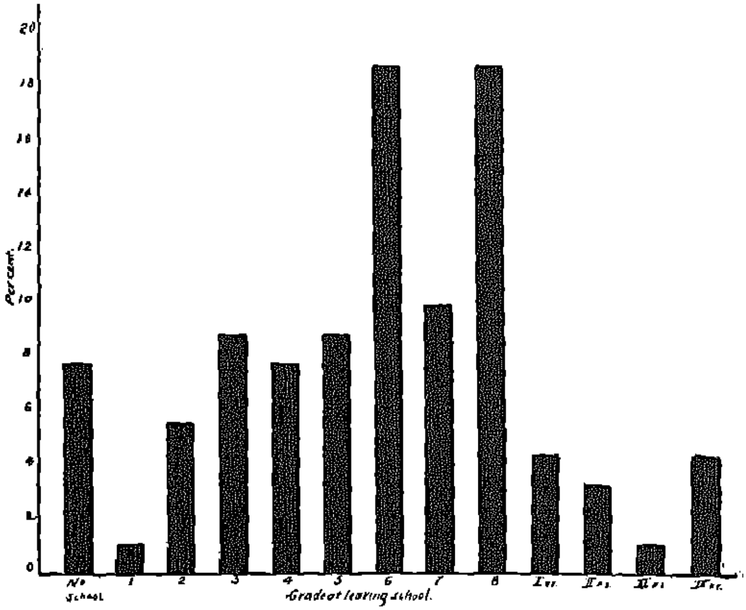
NUMBER AND PER CENT OF 91 CASES LEAVING SCHOOL AT THE SPECIFIED GRADE

Grade at leaving school	No. of cases	Per cent
No school	7	7.7
1	1	1.1
2	5	5.5
3	8	8.8
4	7	7.7
5	8	8.8
6	17	18.7
7	9	9.9
8	17	18.7
I H.S.	4	4.4
II H.S.	3	3.3
III H.S.	1	1.1
IV H.S.	4	4.4
Total	91	100.1
		Median grade at leaving
Whites	49	7.3
Colored	35	4.7
Foreign	7	6.0
Total	91	6.6

There were four colored and three foreign men who had never been to school. Of the group 39.6 per cent had not passed beyond the fifth grade in school. Twelve persons had entered high school, but of these only four had completed the high school course. Not one had even entered college.

These facts are shown pictorially in Graph III. The facts of especial note are the sudden rise in percentage at the sixth grade, the drop at the seventh, and the rise again at the eighth

GRAPH III. PERCENTAGE OF THE GROUP LEAVING SCHOOL AT EACH SPECIFIED GRADE. COLUMBUS, O.



grade. This diagram strongly suggests that the piling up at the sixth grade is due to a class of mentally defective persons who are not able to progress further in school. Concerning this point Woolley[11] says: "Two-thirds of the children leaving our public schools are the failures, and like the rest of humanity, they are tired of doing the things in which they fail."

The distribution of 91 men by school grade and by mental age is shown in Table VII. The fractions of years of mental age are disregarded. The heavy black line indicates the grade which the average child of chronological age equivalent to the mental age indicated would ordinarily have completed; thus an average child of chronological age 7 would have completed the first grade. From the table it is evident that most of the men, according to their own statements, have progressed further in school than their mentality, revealed by the tests, would warrant. We might seek an explanation in several directions:

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[11] Woolley, H. T. Facts about the Working Children of Cincinnati and their Bearing upon Educational Problems. *Elem. School Teacher,* Vol. XIV, 1913, p. 135.

TABLE VII

Distribution of Cases by Grade at Leaving School and by Mental Age

Grade at leaving school	Mental Age 6	7	8	9	10	11	12	13	14	15	16	16+	Total
No school		1	1	1	1	2		1					7
1........					1								1
2........			4		1								5
3........			2	3			3						8
4........	1	1	2	1	2								7
5........			4	3	1								8
6........			8	1	2	2	1				2	1	17
7........			1	1	2	4	1						9
8........				3	3	3	4	1	1			2	17
I H.S..			1			3							4
II H.S..						1		2					3
III H.,S.						1							1
IV H.S..					1		1	1				1	4
Total....	1	2	23	13	14	16	10	5	1		2	4	91

1. The statements of the men as to the actual grade at which they left school are inaccurate.

2. The grades, as reported, do not represent nearly so high an attainment in education as the corresponding grades of to-day.

3. Mentally inferior persons may, in the past, have been quite generally pushed beyond the limit of their abilities.

4. The mental ages revealed by the tests are too low.

It is probably true that the explanation lies in a combination of the first three possibilities with a few cases in which the fourth possibility is a factor. The point to be here emphasized is the large number of poorly educated men side by side with a proportionately large number of more or less mentally deficient.

(To be continued)

AVOCATIONAL GUIDANCE IN MUSIC

CARL E. SEASHORE, State University of Iowa

It may be appropriate to allow the term, avocational guidance, to make its debut in the JOURNAL OF APPLIED PSYCHOLOGY with a word of justification within a specific field. By avocational guidance we understand systematic direction of children and youth in the selection and organization of their avocational pursuits—those pursuits which they will follow, not as occupations but, as diversions and merely cultural quests.

The outstanding feature of vocational guidance is the demand for efficiency. This demand represents a very genuine need and a legitimate aim, but it does not represent the whole situation nor does it represent the highest stage of developmental aim and value. Even the pulpit to-day has as its chief message the demand for efficiency. But is it not likely that the pulpit vocational guidance, vocational selection, and all other efforts of human guidance and direction will emphasize a higher ideal in the near future—that is, the ideal of making a better man rather than a better tool? This is the principle which underlies the justification of avocational guidance. It recognizes the broader aim of self-realization with the aim of efficiency.

Most of the grounds on which avocational guidance in music can be justified are of course identical with the arguments on which we justify vocational guidance in music. First of these is the fact of individual differences. Music is perhaps one of the most striking illustrations that we have of variability in talent. Differences of 1 to 2 in physical height, weight, strength, and other physical measurements would be regarded as large. Differences of 1 to 5 in language, mathematics, history and philosophy would be large, but in music 1 to 25 or 50 or even more are not uncommon. Indeed, music is universally recognized as a gift bestowed upon different individuals in extraordinarily unequal degree. We have then the problem of rating ability in so far as it is possible in order that those interested in a given individual may know just what endowment nature has furnished as a working basis.

Such search for and rating of talent may, of course, be looked upon as a logical part of the great conservation movement in the midst of which we find ourselves. We thought at first of conserving our minerals, water powers, trees, animal life and other material resources, but just to the extent that our educators are awakening to the concreteness of the fact of individual difference and applied psychology is making it possible to identify, measure, and evaluate these, we are beginning to realize something of the actual relative value of such human energy as talent in comparison with the value of merchandisable goods. This point of view is simply a logical step in the recognition of psychology as a natural science, dealing with mental life as observable and controllable phenomena in nature.

Indeed, it is not out of place to speak of saving of life by such conservation, by the discovery of entirely unsuspected genuine talent and the encouragement thereof in such a way as to lead to a self-realization in a great art. Surveys of public schools which we have made recently show clearly that there is but very little correlation between the possession of musical talent and the selection of a child for a musical education; and records of the extent of a child's musical education show no close relationship to the possession of talent. There are, of course, numerous exceptions among those who have a very high order of talent, but these are relatively few in comparison with the number of actually talented. On the other hand there is also a literal saving of life if a youth who enters upon a serious musical career without natural capacity is rescued from the torture of such a career. It is perhaps not facetious to speak of alleviating human suffering, both of the prospective musician and of those associated with him. Thus, in recognizing the possibilities and worth of genuine talent and the futility of trying to make a precious metal out of a base metal, vocational guidance may be looked upon not merely as ordinary conservation but, to the extent that it deals with artistic life, there is an actual saving of the human life.

There is also the economic aspect which we cannot ignore. A statement like the following is significant.

"The editor of one of our leading music journals, with much patience and persistence, and at considerable expense and effort, has gathered statistics, for whose accuracy he vouches, which would indicate that the American people spend each year for musical education the sum of $220,000,000, not including the $7,500,000, which, until the war, was annually spent abroad by American students. . . . We are every year spending approximately *four times as much* for musical education as for all the public high schools of the country, *nearly three times as much* as for all our colleges, universities, and professional schools, and *twenty-four times as much* as for our normal schools; or, in other words, we are spending nearly $40,000,000 a year more for musical education in this professedly non-musical country than for all high school, normal, professional, college and university teaching. Of course, I realize that Mr. Freund's figures might shrink somewhat if subjected to the same pitiless scrutiny as the government reports, but even if they should shrink one-half, they would still overlap by nearly $25,000,000 the largest item in the bill for higher education in this land." *(From the annual address of the President of the National Music Teachers' Association, December,* 1915.)

While we should not for a moment compare the economic values with the value of the artistic powers of the human personality, this economic issue is certainly large enough for the educator to ponder over.

There is no reason for limiting inventories of musical talent to children, because musicians tell us that, in this vast army of music teachers, society has but little protection against the unfit. It is a matter which lies in the distant future, but it would be reasonable to apply accurate and systematic tests to candidates for teaching positions in an art just as much as we apply them to the teaching of a science. We are, however, willing to let the committees on standards in the associations of music teachers practice first on the evaluation of talent among pupils.

Last but of first and of most basic importance for the question at issue is the fact that musical talent is surprisingly concrete, that it can be analyzed and evaluated more accurately and more easily than any other talent. It is evident that "scientific" vocational guidance undoubtedly has one of its most promising first approaches in the field of music because we deal with specific talents which can be analyzed, evaluated and often measured.

Turning then to arguments for avocational as distinguished from vocational guidance, we note, first, the fact that among those who pursue the art of music, only a small portion of individuals are going to pursue music as a profession, *i.e.*, as a vocation. The search for musical talent therefore has much larger bearing upon the selection of avocations than of vocations and the pursuit of an object for the mere pleasure of the pursuit, as in an avocation, should be guided according to fitness and the ability to thoroughly enjoy the pursuit just as much as the pursuit of a profession.

We must also take account of the fact that those who go into a professional career most seriously are often the persons whose natural talent is so clearly outstanding that there can be but little question as to their fitness; while many persons who are not at all aware of their natural gifts in music yet could find in this art a most congenial field for self-expression, aside from a profession, are at present a dead loss to art.

Furthermore, the throwing out of test dragnets which reveal the musical talent is a most effective means for encouraging systematically the cultivation of music as an avocation. It serves the purpose of awakening latent forces for the realization of artistic activities within the community quite apart from professional careers.

Thus we may say that the field of avocational guidance is really very much larger than the field of vocational guidance in music and that it may prove an effective instrumentality in the selection and encouragement of art in the community.

Lest someone shall take fright at the danger of discouraging worthy talent, let it be said emphatically that the expert in the psychology of musical talent looks upon his mission as constructive and aggressive. He looks for talent and not for the absence of it; and where he finds talent he aims to guide it into the proper channels according to its kind and degree. It follows that incidentally the absence of talent will be discovered and occasionally it is important that such absence of talent should be known, but as a rule children have sufficient musical ability to profit by ordinary instruction both in vocal and instrumental music, and the experimenter does not consider it his mission to discourage, except in serious cases.

It is also necessary to point out to the uninitiated that when this professional guidance of music comes into general operation, it will be in the hands of musicians who are not only musicians but also technical psychologists so that they may proceed with all the instincts of the artistic sense of a musician and exercise these in the spirit of psychological procedure. There will then be no danger that the guidance will be cold or disinterested, for the guidance should wherever possible be constructive and sympathetic in the light of a genuine insight into the wonderful reach and ramifications of artistic powers.

It cannot be too strongly emphasized that just as the mere existence of law without the exercise of its force leads to law-abiding life, so the mere existence of standards for the analysis, measurement, and evaluation of musical talent will result in a general awakening on the part of the musical profession, students, and parents to the significance of these facts in such a way that each in his rôle will take common sense cognizance of them; for, after all the greatest good is not to come so much from the measurements of precision in a comparatively small number of cases but rather from the recognition of conditions now entirely overlooked but easily observable by well trained musicians.

The work being done in our laboratory and studio in the University of Iowa at the present time takes three forms. During the past year a series of tests which have been standardized were tried on under the actual school conditions in a number of public schools, principally, Charles City, Sioux City, and Red Oak, Iowa, and St. Louis, Missouri. These experiments convinced us of the feasibility of using a series of tests as a rough dragnet in the public schools, and these tests have now been adapted so as to constitute an integral part of the musical instruction in the fifth grade. The fifth grade is chosen because that is the earliest period at which the tests can be applied with safety as mass tests and because it is early enough to start the musical education of those who have been neglected up to that time.

The tests are based upon the assumption that there are three elemental capacities of hearing necessary for music, namely, the sense of pitch, the sense of time, and the sense of intensity. These are measured separately. In addition, the sense of consonance, auditory memory span, and imaginal type are determined. Each of these tests is divided into two half-hour exercises which may be scattered throughout the year. To these are added statistics about musical education, musical ratings by teachers, the general mental ability, and artistic aims and aspirations of pupils and parents. All the records are reduced to percental rank and interpreted in terms of established norms so that the records on all points are in the same terms, namely, rank expressed in per cent from 0 to 100.

The first object is to find the most promising. A separate list is made of the best 10%, and for these a definite follow-up process is instituted so that both parents and pupils shall be reached. Nearly half of this best 10% are children who have had very little or no musical training. The music supervisor, the teacher, or the principal confers with each child at the end of the series about his record, special care being taken to encourage wherever justified and stimulate musical interest in proportion to apparent ability of the pupil. Thus, even a person who ranks 25% from the bottom is not discouraged from participating in ordinary singing and other musical exercises; but those of average ability are heartily encouraged, and those of superior ability are encouraged with enthusiasm. Those with a very poor record, if they show any interest in the subject, are re-tested to determine if the failure was due to misunderstanding or to actual lack of musical capacity.

Another feature has not yet been introduced in the schools but has been standardized so as to be introduced for all children who give high promise of achievement according to the other tests. That is a series of motor tests. Instead of testing motor capacity in music we determine the basic powers of action such as the speed accuracy and precision of voluntary movement, both in time and form, simple and complex reaction time, and timed-action. These are all measured by a single instrument of precision of remarkably simple construction and are so grouped that it is possible to get a test of all these on a single graphic record in a reasonably short time. However, since this test must be made individually it cannot be made on large numbers whereas all the other tests can be made upon groups of any size up to two or three hundred.

The giving of the tests has been so simplified by the development of apparatus and simple technique that practically any intelligent teacher can give the tests. The remaining difficulty is, therefore, that of finding persons who are sufficiently well informed to interpret the findings scientifically and in the real interest of art.

The dread of sending out an instrument of precision without any control of who is to use it or how it is to be used has made us very conservative about giving publication to these tests. At the present time the directions are available for such persons as may be qualified to use them.

As these tests are progressively introduced into the public school music of the fifth grade, we shall get a survey of the musical talent in a community. The survey is undoubtedly incomplete, but it constitutes a most excellent starting point for the cultivation of musical interests.

A second aspect of the work but one we have not attempted to push on the practical side although some progress has been made, is the introduction of tests of this kind into the conservatories of music. Here a serious difficulty is encountered. It is not considered in accord with the ethics of the profession for the conservatory to send out draguets for the purpose of discovering the musical talent within its constituency, and when the pupils actually arrive in the conservatory it is thought by some that it would be a serious economic sacrifice to attempt to weed out the unfit. On the other hand, it is argued that the conservatory which would set high standards by admitting only those who have natural capacity and base the training upon knowledge of such capacity would acquire a superior standing which would more than compensate for such economic loss.

The third feature which we are developing is that of consultation work. Children or those who have already made some progress in a musical career are received in the laboratory-studio and are given a thorough examination for the purpose of rating each factor in the talent. For some it is a preliminary to the entering upon a musical career, for others a means of finding out the exact nature of the handicap which has been encountered in training.

The body of our work in this pioneer field is of course still in the laboratory being a persistent effort to analyze musical talent, develop measurements, establish norms, and interpret the significance of findings for education and the art of music. The above general statement to the readers of this JOURNAL may, therefore, be regarded as a report of progress.

THEORIES OF STUTTERING[1]

By J. E. WALLACE WALLIN, Psycho-Educational Clinic, St. Louis

Scores upon scores of hypotheses have been advanced from time to time to explain stuttering, and the methods of treatment proposed have been equally numerous. One of the recent theories traces the affection to transitory auditory amnesia; while another theory finds the cause in unconscious emotional complexes, which may be revealed by the method of psychoanalysis (dream analysis, association tests), or in conscious mental conflicts, which, however, frequently originate in some latent complex. Special significance has been ascribed to complexes of a sexual nature and to the use of smutty or profane words.

According to the auditory amnesia or auditory aphasia theory (Bluemel[2]) the individual stutters on certain words because the auditory images of those words become temporarily weakened or are inhibited so that they do not rise in consciousness, in consequence of which the affected person is unable to recall the sounds of the words. Therefore, according to the theory, he will experience difficulty in evoking or pronouncing the words whose auditory images are weak, and this difficulty will assume the form of stuttering. Very few stutterers possess a good musical ear, which is also ascribed to the weak auditory imagery. A rush of blood to the brain when the person is excited in the presence of others, as well as cerebral anemia, is said to lower the activity of the auditory center, thereby inducing auditory aphasia. The primary cause of stuttering is the auditory amnesia. Other causes, such as bewilderment, fear, autosuggestion inhibiting the will, etc., are all secondary. They result from the primary cause. The chief aim of the treatment, accordingly, is to overcome the primary defect, the weak auditory images. The subject must have strong auditory imagery, or none at all. The training consists in attending closely to the auditory sensations. The subject must think of how the words are going to sound, he must continually recall their sounds and let the "primary image" ring through the mind. The refractory images may also be awakened by acoustic sensations, especially the sound of the initial consonant. Hence the subject must begin to articulate the words even if the images are not evoked. The auditory images may also be strengthened by visual and kinaesthetic associations. In fact, the aim should be to have the visual and motor imagery eventually supplement the auditory, so that the subject may be independent of the auditory amnesia whenever it occurs. To this end he should attempt to feel and visualize the articulatory movements. He should observe the movements and positions of the speech organs of others and of himself in a mirror. So much for the auditory amnesia theory.

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[1] We are using stuttering in the generic sense, to include stammering in the specific sense.

[2] C. S. Bluemel. *Stammering and Cognate Defects,* 1913, 2 Vols.

According to Freud[3] there is found "almost invariably" in speech disturbances a "disturbing influence of something outside of the intended speech. The disturbing element is either a single unconscious thought, which comes to light through the speech blunder, and can only be brought to consciousness through a searching analysis, or it is a more general psychic motive, which directs itself against the entire speech." In "the stammering and stuttering of embarrassment" also "it is the inner conflict that is betrayed to us through the disturbance of speech." Coriat[4] has made much of the Freudian conception. He affirms boldly that it has been demonstrated "that the psychogenesis of this disorder ("stammering") is one of the protean forms of an anxiety-neurosis or anxiety-hysteria, and not merely a tic, an obsession, an auditory amnesia or a spastic neurosis of muscular coordination." The neurosis "manifests itself mentally as morbid anxiety and a consequent dread of speaking." "The individual stammers only in specific situations or in the presence of certain individuals and then solely as the result of definite emotional reactions." "For the most part, the motivating mechanism which causes the stammering is unknown to the sufferer. . . the only conscious reaction being that of anxiety and fear." The "association tests" reveal a "form of morbid anxiety due to unconscious emotional complexes, because, as each complex is struck in the test, the typical reaction of the complex indicator follows." The complexes "lead either to no result at all or to a marked lengthening of the reaction time." "The fear in stammerers, as in all cases of anxiety neurosis, at the beginning of the disorder, is merely a protective mechanism to prevent betrayal through speech, and consequently is a protector from attacks of anxiety." The stammering arises as a "defense or compensation mechanism to keep from consciousness certain painful memories and undesirable thoughts, so that they may not be betrayed in speech." "The stammerer attempts to fortify his defective speech organs, because he lays upon these organs undue emotional stress in the effort to conceal and to prevent betrayal, and thus arises the conflict between defective speech and the situations under which defective speech is most apt to occur, thus developing into morbid anxiety and fear." "The attempt to repress from consciousness into the unconscious certain trends of thought or emotions, usually of a sexual nature (libido), is the chief mechanism of stammering." "The fear in stammering is a deflection of the repressed sexual impulse or wish." "The repressed thought, because of fear of betrayal, comes into conflict with the wish to speak and not to betray. *Hence, the hesitation in speech arises*, and as the repressed thoughts gradually are forced into the unconscious there finally develops the defective speech automatism, either stammering or a spastic aphasia." " 'An unconscious complex crowds or presses between the syllable and the word.' " "The dread of speaking to relatives or to intimate friends may be based upon the fear that the unconscious wishes may be discovered and this stimulates the unconscious anxiety whereas with strangers speech is free, because the dread of discovery is absent." "In the *large majority of cases the child did not* begin to stammer until it had been talking freely and normally for several years."[6] " The speech defect arose in childhood as a type of morbid anxiety." "In adult life . . . . the dreams of stammerers are . . . . either dreams of inadequacy with efforts at compensation (not getting there, missing trains, etc.) or typical wish fulfilments, such as talking freely in company or addressing an assembly like an orator." All of the following types of repressed complexes may produce stammering:

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[3] Sigmund Freud. *Psychopathology of Everyday Life*, 1914, p. 80, 113 (Brill's translation).

[4] Isador H. Coriat. Stammering as a Psychoneurosis. *Journal of Abnormal Psychology*, IX, 1914-1915, p. 417f.

1. "Repression of sexual acts or secrets and the fear of betrayal."

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[6] On the question of the age of onset of stuttering the writer may *quote from his investigation of two years ago*: "If we exclude the 251 cases for which no data were supplied and base the per cents on the remaining 432 cases, we get the following results: in 81.4% of the cases the stuttering began before the age of 6 (in many of these 'at an indefinite point in early life'), and in 15% between the age of 6 and 10, and in 3.4% after the age of 10." Cf. *Report of the Board of Education of the City of St. Louis*, 1915-1916, p. 187.

2. "Oedipus complex, with a fear of betrayal of the hate of the father."

3. "Masochistic phantasies."

4. "The fear of pronouncing certain sexual, and therefore, tabooed words," relating to "certain anal, urinary or sexual functions."

5. "As a manifestation of anal eroticism."

From what has been said it follows that "the proper treatment of stammering . . . is purely psychological," namely, the removal of "the deeply rooted anxiety or dread from the unconscious, and this can only be accomplished through psychoanalysis." "The cure of stammering can be attained only through an exploration of the unconscious, a complete breaking down of resistances," "which lead to constant reversions and stickings to the infantile libido with its tendency to conceal itself," "and to a sublimation of the effort to conceal the libido in the unconscious for the pleasure desired." "Every stammerer should have a psychoanalysis, it teaches the sufferer his disturbing complexes, that is, what to avoid and what not to avoid, how to master certain situations and not be mastered by them."

In speaking of the influence of obscene words Freud says:[6] "In some forms of speech blunders we may assume that the disturbing factor is the result of striking against obscene words and meanings. The purposive disfigurement and distortion of words and phrases, which is so popular with vulgar persons, *aims at nothing else but the employing of a harmless motive* as a reminder of the obscene, and this sport is so frequent that it would not be at all remarkable if it appeared unintentionally and contrary to the will." According to Dunlap[7] "in many cases (not in all), the stammerer has especial difficulty with words beginning with one of a small group of sounds—the sounds with which certain obscene words much favored by small boys also begin." "The terms . . . may be in part profane expressions, or merely words like 'damn' or 'hell.'" The stammering began at the time the boy became familiar with these words "which he employed with satisfaction among his juvenile friends but which it would never, never do to let his mother, father or sisters hear." "The boy who is 'carefully brought up,' if he is handicapped by a weak constitution" or "erratic muscular activity" is very apt to become a stutterer, or a stammerer of the deadlock type." It is the

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[6] Sigmund Freud. *Psychopathology of Everyday Life,* 1914, p. 96.

[7] Knight Dunlap. The Stuttering Boy. *Journal of Abnormal Psychology,* 1917, pp. 44f.

"'proper' little boys who become stutterers." "The boy in constant fear lest one of his obscene terms may slip out in wrong company . . . . soon comes to hesitate over every word which begins the same way as do these dangerous words; and as the hesitation becomes a more and more fixed habit, it extends to other types of words also." "Girls do not stutter" because they "do not develop the same fear of revealing a *tabu* vocabulary, although they may have incriminating matter to conceal, and may develop accordingly a hesitating type of stammering." In respect to the cure, "There are far safer and more effective ways of discouraging the taste for bad language than by taking the I-would-be-shocked or the it-would-break-my-heart attitude." "If your small boy commences to stutter, find out what obscene and otherwise objectionable terms the boy is apt to be using," and then tell him "(if you can truly) that you did use those or equivalent words yourself, and have stopped." "Your attitude towards him" should "be no more contemptuous, crushing or sniffling than if he should break out with measles."

We have recently attempted to make a fairly extensive study of the causation and practical treatment of a few stutterers. We here set forth the record of one of these cases, a boy of twelve, whom we had occasion to study and treat during a period of six weeks in one of the mid-western universities. The investigation of the developmental history proved negative, save for an attack of pneumonia at nine months. At eleven months the boy spoke two or three words, and at sixteen months short sentences. He began stuttering at two and a half years. The mother believes that the impediment was acquired imitatively from a maternal uncle whom he heard committing a stuttering selection at that time. He started to imitate his uncle, and gradually grew worse and more timid. At three he had his tonsils clipped. The operation frightened him greatly, and the stuttering grew worse afterwards, it is alleged. At four the tonsils and adenoid tissue were removed, *and, inadvertently, a portion of the uvula.* The stuttering has continued until the present time, although it has abated somewhat during the last year or two. The subject stutters little when at play with boys, or when reciting poetry, while he stutters worse when tired and when speaking in a telephone. The mother thought that the most troublesome consonants were R and M. The treatment which had been followed, consisted in an attempt to get him to speak more slowly. He had been examined by a physician who had pronounced the trouble a "purely nervous affection." He was a good sleeper, ate well, and was not nervous, according to the mother. He had two sisters, aged 4 and 9, neither of whom had ever stuttered.

The physical examination showed that his nervous system was somewhat unstable and rather high strung. Daily observations occasionally disclosed fidgety movements, especially of the hands. He had a severe phimosis, which was corrected by an operation in the hope that the nervous tension would be lessened. According to the Stanford revision of the Binet-Simon scale the subject was advanced two months in intelligence (Basal Age IX); and according to the Seguin form-board he was advanced two years either by the combined norms or by the writer's norms for boys.[8] He had just been promoted to the seventh grade, with a condition in arithmetic and a poor record in music. He sang a few familiar songs in fair tune to the writer, but did not sustain the tones well.

The writer had twenty-three sittings with the subject during a period of six weeks, devoted in part to the investigation of the case and in part to the treatment of the stuttering. During five days of each week the special class teacher took the subject individually also for two daily lessons, following, however, only two of the methods of treatment used by the writer. In addition to this, the subject was asked to practice some of the exercises and follow many of the instructions at home.

The attempt to locate the hypothetical submerged complex by the method of dream analysis proved unavailing. During the six-week period the subject was able to recall only three dreams, although he was urged immediately to jot down his dreams whenever he awoke or whenever he could recall them. He said that he had a faint suspicion that he had one more dream, but could not recall a single fragment of it. On the sixth of the month he "dreamed that he saw a crowd of boys, representing the North and South, playing war. There were about twenty Southern and thirty Northern soldiers. The Southern soldiers were near a log cabin. Three of the Northern soldiers scared the Southern soldiers so that they ran away through the back door. I asked the Northern soldiers to catch them. Then I saw the Southern soldiers come back to the log cabin and go inside, where the Northern soldiers captured them. They put them in jail about five miles from our camp. I was near the Northern camp, and fought with the North. I shot with a gun, but did not hit anyone. I felt no fear." On the seventeenth of the month he dreamed that he was at home, but could not recall a single detail, and six days later he dreamed that he "was home riding around in his wagon (he has a pony), and that he played hide-and-go-seek, tag, and other games with boys and had fun." He could not recall any further details. Some psycho-analyst may be able to find from these bare fragments the symbolism and the latent complex or inner conflict at the root of the stuttering. Our attempt to expound the symbolical character of these dreams to the subject and to bring the hypothetical submerged complexes into consciousness proved abortive, so far as concerns any salutary effect on the stuttering. This does not constitute a valid criticism of the method of dream analysis, because of the paucity of the dream material secured from this subject. The legitimate use of the method requires the analysis of many dreams. The method has, however, proved ineffective with two other stutterers (youths) who have reported far more dreams. These dreams have been "analyzed" independently by two students familiar with Freud's works and by myself. There is little agreement in the three analyses respecting the interpretation of the dreams or the character of the symbolism read into them. It would be profitable to subject to an unprejudiced analysis the psycho-analytic interpretations which have been offered by a considerable number of analysts who have not had access to each other's interpretations, of several extensive sets of the same dreams. The subjective, individual and fantastical nature of much psycho-analysis would in this way probably be brought clearly to light.

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[8] Table XLIX, in the writer's *Psycho-Motor Norms for Practical Diagnosis*, 1916.

The results of the use of the association-reaction test was also disappointing. The stimuli which we used consisted of a series of words read aloud distinctly by the experimenter. None of the words was shown to the subject. After each word had been read, the reaction-word and the reaction-time (taken by a stop watch showing fifths of a second) were recorded. These responses are recorded in the column headed "reaction-words" in the accompanying series. After the entire series of words had been presented and the reaction-words recorded, the subject was asked to try to reproduce the same reaction-word as he had previously given as each of the stimuli-words was again read. These results are recorded in the column headed "reproduction of reaction-word." Series 2 was given eleven days after series 1, Series 3 seven days after Series 2, and Series 4 the next day after Series 3. We had in view a three-fold aim in the employment of this test. First, to bring to the surface any possible emotional complexes or conflicts whether conscious or subconscious. The test has been used for this purpose, on the assumption that when a given word "touches" an emotional complex, or a latent complex ("complex indicator"), the reaction to the word in question, or to the following word or words, will be delayed or even blocked. By analyzing the type of words causing delayed reactions in a given series or a number of series, or interrogating the subject in connection with the words which caused delays, it is possible, according to the theory, to determine the nature of the emotional complex. Manifestly it is no easy matter to construct lists which shall contain a number of significant words, when the history of the case is negative, so far

SERIES I

	Immediate Reaction		Reproduction of Reaction-Word	
Stimulus-Word	Word	Time		
Head..............	Red	2.2	+	2.8
Green............	Blue	2.2	+	9.0
Long.............	White	2.0	+	23.0
Death............	Black	5.0	+	3.0
To pay...........	You	7.2	He	7.8
Window..........	Brown	8.0	+	2.8
Father...........	Home	7.6	+	2.4
Lake.............	Blue	3.0	+	2.0
Kind.............	Are	7.0	Pink	16.0
Mother...........	Home	22.0	+	3.0
Boat.............	Row	2.2	+	2.0
Sister............	Play	13.2	Home	2.2
Candy............	Pink	3.2	+	2.0
Fall..............	You	8.4	He	4.0
Run..............	I	4.0	+	4.0
Sing..............	I	10.4	He	4.0
Scream...........	You	11.0	She	3.4
Summer..........	Sunshine	15.0	+	8.0
Brother..........	Swim	8.6	+	7.0
School...........	Summer	6.2	+	1.4
Nurse............	The	6.2	+	2.1
Funny............	Clown	11.0	+	1.4
Talk.............	She	11.0	I	5.2
Money...........	Bank	29.0	+	4.0*
Girls.............	The	4.4	+	4.2
Swim.............	You	7.2	He	3.0
Steal.............	He	5.0	You	5.0

The unit of measurement in all the series is seconds. A plus sign in the delayed reproduction column in all the series indicates that the word given in the immediate reaction was correctly reproduced. In the case of incorrect reproductions the wrong word is given in the reproduction column.

* The subject stuttered on all of the words marked with an asterisk (*).

SERIES II

Stimulus-Word	Immediate Reaction		Reproduction of Reaction-Word	
	Word	Time		
Sun	Run	2.0	+	1.0
Winter	Snow	1.4	+	1.0
Desk	Brown	2.6	+	2.0
Skates	Ice	2.2	+	1.4
Jump	You	3.0	+	2.0
Ball	Hall	2.2	Fall	15.0
Pretty	White	5.0	+	2.0
Knife	Butcher	13.8*	+	6.8†
Lost	She	4.0	+	4.2
Father	Home	25.6	+	3.0
Hit	He	2.2	You	6.2
Hat	The	2.4	+	4.2
Bank	Savings	10.0	+	2.2
Scream	She	5.2	You	2.6
Pants	The	2.8	Holy	5.2†
Snow	White	5.0	+	2.4
Money	The	12.0	+	10.2
Tree	Brown	3.6	+	2.2
Death	Funeral	7.6	+	2.2
House	Black	5.2	+	4.0*
Sister	Play	7.0	+	1.6
Train	Smoky	4.2	+	11.4
Bridge	Cement	4.0	Smashed	2.0
Pump	Smashed	2.4	+	4.0
Swear	You	6.0	+	1.2

† A slight interruption occurred here.

SERIES III

Stimulus-Word	Immediate Reaction		Reproduction of Reaction-Word	
	Word	Time		
Mill	Flour	3.2	Wind	22.2
Music	Violin	3.4*	+	4.8
River	Steamboat	4.0	Fall	2.2
Stone	Cement	4.0	+	7.0
Whistle	Boy	14.0	He	4.8
Little	Hen	4.4	+	3.0
Barking	Dog	3.4	+	5.2
Elephant	Stout	7.2	+	2.0
Calling	She	3.0	+	3.4
Rock	Fall	5.2	+	6.2
Rattling	Iron	12.0	+	3.6
Little	Sparrow	3.0	+	2.0
Mother	Home	12.4	+	1.8
Roll	Ball	5.4*	+	4.2
Kitty	Brown	5.0	+	3.4
Cry	You	10.0	They	3.0
Horse	Brown	5.0	+	1.6
Singing	She	3.0	+	8.4
With	He	10.2	You	5.4

SERIES III—*Continued*

	Immediate Reaction		Reproduction of Reaction-Word	
Stimulus-Word	Word	Time		
Stamping	Horse	3.2	+	1.8
Noise	They	6.8	—	17.0
Shoe	Horse	3.0	+	1.8
Thunder	It	4.0	+	12.0
Fun	We	3.0	+	2.4
Shine	Shoes	3.0	+	2.0
Fool	They	7.4	You	5.2
Kiss	I	7.2	+	2.0

SERIES IV

	Immediate Reaction		Reproduction of Reaction-Word	
Stimulus-Word	Word	Time		
Door	Floor	2.2	+	1.8
Darn	Boy	5.4	+	4.4
Fire	House	3.2	+	7.4
Arm	Strong	4.8	+	3.4
Leg	Weak*	3.4	+	2.0
Hole	Floor	4.2	+	3.6
———	Cement	6.4	Boy	6.4
He	She	3.0	Boy	15.0
Sun	Fire	5.6	+	2.4
Hell	Boy	3.8	Cement	10.0
Dig	Cement	5.6	+	6.2
———	Horse	4.6	Mule	3.6
———	Dog	5.4	+	5.2
Dam	Cement	4.6	+	4.0
Cook	Supper*	4.8	+	5.6
Girls	Bad	6.4	+	3.2
Alone	She	2.2	+	3.2
God	Heaven	13.4	+	2.2
———	Mule	6.8	+	1.6
Love	She	3.0	He	2.6
Car	Smashed	4.2	+	1.4
———	He	4.0	+	2.4
Shirt	Stripe	5.0	+	1.6
———	He	3.6	Barn	15.0
Prunes	Brown	4.8	+	2.6

as the obtained information goes, as regards occurrences which, by implication, would have caused mental conflicts, or emotional upheavals in the life of the subject. Careful inquiry of the mother (and tactful questioning of the subject later) did not disclose any grounds for such conflicts in the present instance. Arbitrary lists have in the past been constructed and these lists have been used with naive confidence in their revealing efficacy by some writers. We have included a few words from one of these lists. But to maintain that all the words in a custom-made list which are associated with delayed responses reveal an inner conflict or emotional complex, may suffice for the unsophisticated devotee of a cult but surely cannot satisfy the critical experimental scientist[9] who demands facts capable of objective verification. We included a few words like *death, father, mother, sister, brother, nurse, girls, scream, bank, money, steal* (the father was a banker), which we thought might have been associated with unpleasant experiences in the past, and with submerged conflicts at the time. As will be seen later, some of these words produced delayed responses while others did not.

The second purpose in employing the association reaction test was to determine whether the subject stuttered because of the present or past use of indecent or profane words. The assumption made is that the subject will stutter on words beginning with the same letter as one of the foul words, and hence the record should show that the subject stuttered on such words, or that the responses were delayed. We may also assume, according to the theory, that the subject either will stutter or the reactions will be delayed when he attempts to repeat the vulgar words themselves, or when he reacts with another word to them, because he will feel ashamed and get flustered when he hears the objectionable words. In the last association reaction test which we gave, we introduced nine inelegant or obscene words, some of which we have indicated by dashes. On the following day we asked the subject to write out a list of all the "bad," "ugly" or "nasty" words which he had ever used and also a list of indecent words which he had heard other boys use. The former list included only the word "dam fool"—the parents later said this was the only bad word they had heard him use, but it is probable that he had used others, in fact he said he had been punished for using bad words—while the list of bad words which he had heard others use included four which we used in Series IV and two which we did not use.

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[9] One is tempted to quote Solomon's stinging rebuke of some of the Freudians, in discussing the etiology of stuttering: "I must stoutly protest against an evasion of the real issues by the leaders of the Freudian movement. Let them retrace their steps and first prove the truth, soundness and validity of their psychological and sexual theories and cease pressing on to pastures new." "If they are not prepared to do this, or are unwilling so to do, I do not believe that they are entitled to continue to inflict upon others views which have little real foundation in fact, which are unproven, unfounded, purely speculative, imaginative, pure figments of the imagination, a delusion, and a snare." . . . . "Not a single case has been presented in proof of the conclusions drawn in the paper. Surely this is not what we have been accustomed to expect in other fields of medicine." "I venture to say that in no department of medicine or in fact in no other aspect of life would scientific men tolerate presentation and promulgation, despite opposition and disproof and with no tangible or definite evidence or proof." (Meyer Solomon. Remarks upon Dr. Coriat's Paper, 'Stammering as a Psychoneurosis.' *Journal of Abnormal Psychology*, 1915, 130 f.) Solomon may be interested to know that a similar vociferous "promulgation" has gone on in another phase of psychological diagnosis, the diagnosis of mental deficiency by means of mental tests and arbitrary standards the validity of which has never been demonstrated by methods which will stand a scientific test. On the basis of this procedure the public has been regaled for years with the most exaggerated statements of the prevalence and criminal menace of the feebleminded. Some workers have habitually diagnosed persons whom they have never seen (much as the mental healers diagnose and heal at a distance), on the basis of tests given by amateurs, and these results have been repeatedly referred to as "conservative" and as "scientifically demonstrated." Fortunately for clinical psychology a period of critical evaluation is setting in, the influence of a body of critical workers is gradually permeating through the ranks, and less denunciation is now heaped upon any one who ventures to question the "ipse dixit" than was the case within a period of time that is still green in memory.

The third aim of the use of the association reaction test was to determine whether the subject suffered from auditory amnesia. The assumption was made that auditory amnesia should affect words whose images are predominantly auditory rather than visual or motor, and that the responses to such words should be delayed, owing to the difficulty of evoking them or the tendency to stutter on them. This assumption, it seems to us, is a natural consequence of the theory, although we would not be understood as attempting to justify it, for many persons undoubtedly visualize words which are predominantly auditory in character. It is evident, therefore, that in selecting a list of words with auditory imagery we cannot dogmatically affirm that the subject did not actually use visual or motor images rather than auditory images. But this merely proves how inherently intricate and difficult of solution this kind of a problem is.

The average and median reaction-times for the reaction-words and the later reproductions of the reaction-words in the different series are as follows:

	Series I		Series II		Series III		Series IV	
	Av.	M.	Av.	M.	Av.	M.	Av.	M.
Reaction-words	8.2	7.2	5.6	4.0	5.7	4.4	4.8	4.6
Reproduction-time	5.7	4.0	4.0	2.6	5.1	3.4	4.6	3.4

Av.= average. M.= median.

It is observed that the time for the reproductions is invariably shorter than the time for the original reactions. The responses were the slowest in Series I, for both the reaction-words and the reproductions, while they were the fastest in Series IV, which contained the offensive words, if the results are based on the averages (one exception). Based on the general averages or medians for each series there is no evidence of delayed responses in the series containing the reprehensible words.

The following are the stimuli words which produced the slowest reaction-words in each series, together with the average and median reaction-times for the reaction-words and for the reproductions.

	Series I	Series II	Series III	Series IV
	Mother	Knife	Whistle	God
	Sister	Father	Rattling	....
	Sing	Bank	Mother	Girl
	Scream	Money	Cry	....
	Summer	Death	With	....
	Funny	Sister	Fool	....
	Talk	....	Kiss	....
	Money	....	....	....
	Time for Reaction Words			
Average..	15.3	12.6	14.5	8.2
Median ..	12.1	11.0	10.2	6.6
	Time for Reproductions			
Average..	3.9	4.3	3.6	3.3
Median ..	3.7	2.6	3.6	2.7

The impressive point about the above figures is that while, as a matter of course, the times are invariably longer for these reaction-words than for the reaction-words in the corresponding complete series, the times are shorter for most of the reproductions than for the reproductions in the corresponding complete series. In other words, conclusions based on the time required to give the reaction-words would not at all apply to the reproduction of the reaction-words, and the question must inevitably arise which series should furnish the criterion. It has been assumed that when stimulus-words cause delayed reactions the later reproductions of the reactions will also be slower and more difficult or impossible. To be sure, the reproductions were not always correctly given for these slow reaction-words. More than half of the reproductions in Series I and III and half in Series IV were wrong, while all of those in Series II were correct. But wrong reproductions are also frequently found with rapid reaction-words. Moreover, the time for the correct and incorrect reproductions does not differ significantly. We also find instances in each series in which the reproduction-times are slow when the reaction-times are rapid, e.g.:

	Series I	Series II	Series III	Series IV
	Kind—	Ball—	Mill*	Fire
	Green	Train	Singing	He—
	Long	....	Noise—	....
	Nurse	....	Thunder	....
	TIME OF REACTION-WORDS			
Average..	4.3	3.2	4.2	3.1
	TIME OF REPRODUCTIONS			
Average..	17.2	13.2	14.9	11.2

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* Stuttered.

In only 4 of these twelve words were the reproductions incorrect. These instances are indicated by the minus sign following the stimulus word. The responses were slower for some of these incorrect reproductions, but not all. We are unable to find any "common element" that is responsible for the wrong reproductions.

An analysis of the individual words given on the previous page which produced the slowest associations shows that eight of those given on page 359 are included while three are not, namely "brother," "nurse" and "steal." The original reaction to "death" in Series II was only slightly delayed, but it was not delayed in Series I, while the reproduction times were faster than the general averages in both series. The word "scream" produced delayed associations in I but not in II, while the reproductions, although wrong, were accelerated in both series. The reaction-words to "mother" and "sister" were delayed in both I and III, and to "father" in II, but not in I, while the reproduction times are shorter than the general averages in both series. The reactions to "brother" were average. The reaction-time to "girls" was slightly delayed in IV but accelerated in I, while the reproductions were faster in both Series I and IV. The parents, however, said that the relations were not strained between them and the boy, while the boy also made the same statement, although he said that his father had sometimes punished him and he sometimes got into trouble with his sister. The word "bank" produced a delayed reaction but an accelerated reproduction in II. The word "money" produced delayed reactions in both I and II, and the reproduction was delayed in II while in I it was accelerated although the boy stuttered on the word. He was not known to have appropriated any money. The word "steal" did not produce any delayed association, although the reproduction of the association was wrong. From this it might be inferred that the boy had had trouble with the family over money matters, although he was not known to have stolen.

The list of delayed reactions on page 361 contains a dozen words which were not included in our list on page 359. These words were given only once. The time for the reproductions of the reaction-words was less than normal for most of these words. The list includes such widely varying words as, *sing, summer, funny* (but *fun* produced an accelerated response), *talk, whistle, with* and *God*; and we do not believe that a minute analysis of these words would shed any particular light on our problem. Had the words been repeated several times they would probably have shown both delayed and accelerated responses, as did some of the other words.

The average time for the reactions to the nine obscene words in Series IV is 4.9 (median 4.6), and for the reproductions 5.8 (median 5.2). The time for the reaction-words is shorter than it is in Series I, II and III (except for the medians in II and III), and practically the same as in Series IV. On the other hand, the time to reproduce the reaction-words is consistently longer for the obscene words than for the words in any of the complete series, although the differences are sometimes negligible. It is evident that the conclusion drawn would be antithetical according as the results were based on the original reaction-words or on the reproduction times. Most workers would probably make the original response the criterion, in which case the obscene words produced a result directly opposite to that demanded by the theory. We have already called attention to the fact that the average time for the reaction-words is the shortest in Series IV. Based on the time of the responses, we find no evidence that the obscene words "touched" any submerged complex or produced any emotional perturbation when first read—the subject seemed to flush and grow slightly disconcerted only twice—while they produced only slight perturbation when read the second time. The subject did not stutter once on these reaction-words or reproductions, while six of the reproductions were correct.

It has been said that the emotional delay or blocking of the associational processes may appear only in the words which follow the exciting words. To test this theory we have averaged the time for the reaction-words to the first word following each of the objectionable words. The average is 4.3 (median 4.8), while for the reproduction of the reaction-words the average is 5.5 (median 5.2). In other words, the reaction times are actually shorter for these words than for all of the words in any of the complete series (except for the medians). However, we again find that the reproduction times for these words are slightly longer than in the complete series, but the differences are not large.

We have also compiled the reaction rates for the words in the different series, which begin with the same letters as do obscene or inelegant words. The following figures represent the average times (in seconds) for all the stimulus words in the four series which begin with the designated initial letters (i.e., the letters which begin some obscene or profane word):

Letter	No. of words	Time for reaction words	Time for reproductions
A	3	4.6	2.7
B	7	5.1	5.5
C	7	5.1	3.6
D	6	5.1	3.6
F	8	8.7	3.5
G	4	6.6	4.6
H	8	3.5	5.9
K	3	8.6	8.7
P	5	3.7	5.7
S	19	6.3	3.1

In the main—we cannot take space to compare each initial with the average for each series given on page 360—the times are shorter for the reaction-words beginning with six of the above initials (A, B, C, D, H, and P) and longer for only four (F, G, K, S), and about the same relation holds for the reproduction series. It is evident that the results obtained from the reaction-word times and reproduction times are again contradictory for some of the words. The long reaction time which we find for the F-words is reduced to 6.3 if the word "father" is excluded in the second series, where it is abnormally long. On the whole, we do not find any greater tendency to stutter on words beginning with the initials of obscene words than on words beginning with any other letters,[10] judged by the reaction times or the tendency to stutter on the responses.

But it may be objected that the words beginning with the above initials should not have been selected from the list of stimulus words, but from the subject's responses, because it is only claimed that stuttering affects those words which are actually spoken by the stutterer and which begin with the initial of the forbidden words. To test this theory, we have averaged the reaction times required by the subject to utter the words in the different series which begin with the initial of one of the objectionable words. The averages are as follows:

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[10] Some of the words on which the subject stuttered most, beginning with the most severe, were: *little, Prentice, with, kitty, roll, rock, went, mill, river, rest, problem, cow boy, up, sixteenth, press.*

Letter	No. of words	Time for reaction words	Time for *reproductions*
A	1	7.0	16.0
B	17	6.8	3.9
C	6	5.9	4.5
D	2	4.4	2.6
F	6	4.6	6.4
H	16	7.9	4.9
P	3	7.8	1.9
S	23	5.1	4.3

Exclusive of the first letter, which is based on only one occurrence, the time to give the reaction-words is, on the whole, somewhat longer for four of the initials (B, C, H and P) than the subject's normal time in the four series, and somewhat shorter for three initials (D, F and S). If "home" which has an abnormally long reaction time in Series I and II is excluded the average for H is reduced to 4.1, which is less than normal. When we turn to the reproduction series, we find that the time is shorter for all the initials except F, where it is longer, and H, where it is about the same. There are a number of instances in which the wrong reproductions begin with the above initials, but they are not included in the averages. *Most of them, however, show no delays.*

It is evident that the results from the dream analysis and the association-test only justify a negative conclusion with respect to the causal relation of the stuttering in this case to submerged emotional complexes or the use of words which begin with the initials of vulgar words. This conclusion is in harmony with the "general impressions" which remained after a study of all the aspects of the case. The therapeutical effects of the above methods of analysis were nil. The only "complex indicator" which we could make out was possible friction of the boy in the home with the rest of the family. We pointed out to the subject how this was indicated by the tests, but, as stated above, the implication was denied. Moreover, the attempt to render the "latent" content "manifest" did not mitigate the stuttering. The boy also said that he did not have nor had he had any fear of using "bad" words in the presence of his parents or of older persons or of girls. He was told that his stuttering was due to the use of such words in as many respectable persons had used such words. He was the past, but that this was nothing to feel ashamed about now, *told to stop paying any attention to this or worrying about* it, and the impression was strongly conveyed that following this advice would soon cause the stuttering to stop. We felt, however, that this line of treatment was quite impotent.

We are not yet prepared to say that the method of psychoanalysis has no value in the analysis and treatment of stuttering. There may be cases in which it is applicable. We have made an attempt to apply it, so far as our limited time has permitted, to three cases—the other two more mature than the present patient—but with unfavorable results. Naturally we have become soberly conservative with respect to the glowing claims which have been put forth in behalf of the theory. Very few of these claims have been substantiated by detailed experiments and observations and by adequate follow-up reports. Owing to the skill and the great amount of time needed to apply the method, it cannot be used, even if it were effective, in a large school system with a large number of stutterers.[11]

As we have before intimated, it is impossible to determine with absolute accuracy the type of imagery which any one may use in connection with a given word. This is particularly true when the subject finds it hard to determine introspectively what images actually appeared with different words. Our time did not enable us to secure extensive introspective data from the subject of this investigation. The data we did secure indicated that his word imagery was of the mixed type. In the following tabulation we have given the words in each series in which the imagery ought, apparently, to be predominantly auditory.

The time required to give reaction-words to these "auditory words" is the same as the normal rate in Series II (p. 360) and longer in Series I, III and IV, but the difference is negligible in III and IV. In fact, the median (4.2) for the auditory

Series I	Series II	Series III	Series IV
Sing	Scream	Music	Darn
Scream	Swear	Whistle	Dam
Talk	....	Barking	....
....	....	Calling	....
....	....	Rattling	....
....	....	Cry	....
....	....	Singing	....
....	....	Stamping	....
....	....	Noise	....
....	....	Thunder	....

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[11] We have found peripheral methods more successful. The method of contracting the muscles of the lower jaw, with slow, deliberate speech, and sometimes with contraction of the hands, works fairly well with some cases, while the method of muscular relaxation and mental sangfroid gives fair results with others.

TIME FOR REACTION-WORDS

Average..	10.8	5.6	6.2	5.0

TIME FOR REPRODUCTIONS

Average..	4.2	3.8	6.4	4.2

words in Series III, which contains the largest number, is slightly smaller than the median for all the words in III. The times for the reproduction of the reaction-words are all shorter than the normal rates in all the Series except III. Seven of the seventeen reproductions were wrong, but the time was not abnormally long in these except in one instance. We cannot conclude from the association experiment that for this subject any special significance attaches to auditory words, that he suffers from auditory amnesia or that auditory amnesia has aught to do with his stuttering. While we do not consider the reaction experiment as absolutely conclusive on this point, the words on which the subject stuttered the worst (p. 364) were not auditory in character. Moreover, we explained clearly the theory of auditory amnesia and told the boy that his stuttering was due to his inability to get auditory images, and that it would disappear after he had learned to think of how the words are going to sound before he attempts to speak them. He said he thought he had been able to get auditory images of words. Nevertheless we asked him to practice daily at home (during the last three weeks) on imaging the sounds of words. In our daily exercises we also had him spend a certain amount of time in the effort to get vivid auditory images before he attempted to utter words on which he had frequently stuttered. He was frequently told to close the eyes and keep his mind on the sound of the word. If he was unable mentally to hear the sound, he was told to whisper the word. When he felt that he had a clear image of the sound he was asked to speak the word and was assured that he would be able to do so without any difficulty. These exercises seemed to lessen the tendency to stutter at the moment—possibly due to the confidence we instilled in him—but the subject continued to stutter on the same words on other occasions, and we saw no permanent improvement from the employment of these exercises within the time limits of the experiment. We felt that the subject obtained more benefit from our physical-relaxation and mental-composure exercises than from the "auditory" exercises. From our own experience with stuttering cases we feel that much more work of scientific caliber must be done before the newer theories of the affliction can be accepted as proved. This work will probably have to be done by men who come to the problem without prepossessions.

HANDWRITING DISGUISE

By June E. Downey

The determination of the extent to which handwriting may be disguised is a problem of considerable importance from at least two points of view. On the one hand, as a practical problem, of great interest from the legal standpoint, it arises in connection with the imitation of the writing of others in forgeries that are not traceries and in the "masked" writing of the anonymous letter. On the other hand, from the psychological or theoretical side, the range and method of handwriting disguise is of significance in connection with the utilization of handwriting in psycho-diagnosis.

Our concern is mainly with the second of these two considerations. In passing, however, it should be observed that the handwriting experts have much to say concerning the difficulties involved in the identification of handwriting and in the determination of the original of a disguised hand. They insist upon the need of cautious procedure; they list the sources of possible error; and they warn against the acceptance of the unsupported opinion of the incompetent and untrained witness. Mr. Albert Osborn, the New York Expert, writes,[1] "There are two main questions that confront the examiner of an alleged forgery. The first of these is how much and to what extent may a genuine writing diverge from a certain type, and the second is how and to what extent will a more or less skillful forgery be likely to succeed and be likely to fail in embodying the characteristics of a genuine writing." These two questions (1) of the limits of variation in a natural hand and (2) of the graphic characteristics that may or may not be easily assumed are of first importance from the theoretical side also.

A significant item of difference between the emphasis of the handwriting expert and that of the psychologist should, however, be noted. The expert approaches the problem largely from the standpoint of the degree of credibility of the witness testifying in court concerning the genuineness of handwriting. The psychologist would press the matter further back and determine, if possible, the reason for the great individual differences that exist, apart from training, with respect to observation of handwriting individuality. Furthermore, he is most curious concerning the varying capacity for disguise exhibited by different penmen and the mental temperament that lies back of virtuosity in the assumption of different handwriting individualities. Lastly, he would question what are the psychophysical factors that determine the ease or difficulty with which different graphic elements may be voluntarily altered.

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[1] "Errors in Identification of Handwriting." *Am. Law Review*, Vol. 48, 1914, p. 48.

The problem of control in handwriting, which is a basal one so far as psycho-diagnosis is concerned, centers about two problems both of which are open to experimentation: (1) The extent to which disguise of one's habitual handwriting is possible and (2) the extent to which voluntary control is maintained in conventional writing as evidenced by the changes that take place in automatic writing or writing under distraction. In everyday life an obvious indication of this latter change is the difference between writing furbished up for state occasions and writing designed for domestic purposes, in negligee so to speak. In ordinary writing, control becomes progressively less rigid as one becomes interested in the content of what he is writing or as speed of writing increases. The first half of each word, the first half of a written line, and of a manuscript give evidence of greater control than does the second half. The significance of this variation in conscious control, so often emphasized by graphologists, need not detain us here. Instead let us turn to the problem of voluntary disguise of handwriting.

For scientific purposes one strikes the problem at close quarters by an experimental treatment such, for instance, as that of Dr. Georg Meyer.[2] Meyer approached the question from four different angles: (1) Which graphic characters can be *repressed* voluntarily? (2) Which can be assumed *voluntarily*? (3) What is the result of a deliberate attempt to disguise handwriting? (4) How far is imitation of another hand possible?

To obtain an answer to question 1, a large number of subjects were asked to write as calligraphically as possible, in true copy-book style of the schoolroom. Normals were also obtained for comparison. To obtain an answer for question 2, definite variations in particular graphic characters were asked for from twenty-five different reagents. Question 3 was answered by asking subjects to disguise their writing;

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[2] "Ueber Schriftverstellung." *Graphologische Monatshefte*, 1900, IV, pp. 1-12; 105-120; 125-139.

question 4 by asking for imitation of specific hands. From his study of the methods of intentional disguise employed by unsophisticated subjects, Meyer was able to draw some interesting conclusions concerning the graphic elements that are least subject to control, which in the main are precisely those to which the average observer pays least attention.

I have notes on an experiment of my own similar in purpose to that of Meyer but developed in a somewhat different manner.

I asked twenty-four unsophisticated subjects to write a given verse on an unlined sheet of standard size and quality in their usual manner. I then requested each of them to rewrite this verse on a second similar sheet but disguising their hand-writing as far as was possible. No instructions were given as to method of disguise. Each subject could take all the time and pains that he cared to in the disguise, which was prepared *away* from the laboratory. In selecting my subjects I chose twelve of each sex. With reference to age they fell into two groups also, twelve under twenty-six years of age and twelve over thirty. The younger group was, with one exception, composed of college students; the older group, with three exceptions, of University instructors. Four of the latter were psychologists. Such a selection of subjects was dictated by a desire to see whether age and sex were factors governing success in disguise. The degree to which a given disguise was held to be successful was determined by the submission of the series of disguised and undisguised writings to sixteen reagents for matching and the counting of the number of times a disguised specimen was correctly matched with the undisguised specimen written by the same penman.

The material obtained in this manner was worked over with the following questions in mind: (1) What methods of disguise were utilized by the group of subjects? (2) To what extent were the individual attempts at disguise effective as determined by the percentage of failures on the part of the judges in identification of the disguised hand? Were the younger penmen more successful than the older ones in disguise? Was there any difference in the percentage of successes of men and women?

In an attempt to answer the first question, out of almost numberless observations that might be made relative to changes in the graphic characters, tabulation was limited to the obvious shifts in size, slant, pressure or line-quality, form, continuity, alignment, connecting-stroke, relative proportion, and i-dot. See Table I.

TABLE I

METHODS UTILIZED IN DISGUISE OF WRITING BY 24 SUBJECTS

Number of Times There Was a Noticeable Shift In

Size, 17	Slant, 16	Pressure, 15	Form, 16	Alignment, 16	Continuity, 11	Connecting-stroke, 17	Proportion, 16	i-dot, 5
Decreased 11	To back-hand or vertical 15	Increased 12	Ornamented 8	Straightened 6	Decreased 8	More rounded 12	One space letter 7	Change in form 5
Increased 6	To right 1	Decreased 3	Fantastic 2	More serpentine 4	Increased 3	More angular 5	Increased down stroke 5	In localization ?
			Simplified 6	Rising 4			Decreased down stroke 2	
				Falling 2			Increased up stroke 2	

A word of comment upon each of these chosen elements is desirable. A change in size of writing is a frequent outcome of disguise, a decrease being more common than an increase in size. There is, in fact, in the given specimens no case of increased size comparable to the extremes of decrease. The decrease in size of letters is usually accompanied by a greater compactness in texture leading to a compression in the horizontal extension. This same compression appears also in a few cases in which the writing is increased in size but, usually, increased amplitude is accompanied by a looser texture.

A shift in slant was also noticeable in the disguised hand, usually in the direction of the vertical or backhand. Such a change is one that readily appeals to the unsophisticated, although handwriting individuality is but little dependent upon slant of writing.

The degree to which pressure varied in the natural and the disguised hand cannot be told with any degree of accuracy from the written product. Experiments on pressure demand actual instrumental registration. Certain changes in line-quality were, however, very evident in a large number of cases. In a majority of specimens this change is in the direction of a heavier line. I do not find, unfortunately, a record of how many of my subjects used a different style of pen in attempting to disguise their hands, but in any case it is unlikely that such a shift accounts for the uniformity in direction of change.

In consideration of variations in letter-form, the writing-specimen was scrutinized to determine whether on the whole there was simplification or conventionalizing of the natural hand or whether the reagent attempted to disguise his hand by the employment of superfluous ornamentation or fantastic forms. Recourse to a conventional vertical hand or to print is one of the most effective means of disguise but it is more difficult to achieve than a hand decked out with all manner of superfluous curls. It demands more consistent motor control. The tabulation given overlooks the many details of form that would be so carefully noted by the expert in attempting to prove or disprove the genuineness of a given writing. Individual mannerisms, tricks of style, are often revealed in the form of individual letters and one of the most interesting questions involved in disguised handwriting is the extent to which a penman is aware of his individual peculiarities and the consistency with which he is able to avoid tell-tale mannerisms. Such observation does not, however, lend itself to tabulation. Changes in capitals are more easily achieved than changes in small letters; they are made with a higher degree of consciousness.

A change in alignment occurs frequently but without much uniformity as to the direction.

The degree of continuity in a given hand is one of its most distinctive marks. This character is held to be very largely dependent upon the general smoothness and regularity of the motor impulse, a matter to a considerable degree, of the original constitution. A break in continuity is much more easily initiated than is increased continuity.

Changes in the form of the connecting stroke occur frequently, more commonly from an angular to a rounded connection than the reverse.

While absolute size of writing is easily shifted, relative proportion of parts is pretty constant. There are, however, a very great number of possible observations relative to proportion, among them the following: relative proportion of strokes above and below the line, relative size of one-space and three-space letters, relative horizontal and vertical space relations of the one-space letters, relative proportion of capital and strokes above the line. It is much more difficult to vary some of these proportions than others. For example, from my results, it appears that a change in the relative size of the one-space letters is not infrequent, while changes in the relative proportion of up and down strokes is less often observed. An increase in the relative length of an up-stroke is said to be particularly difficult to achieve and my specimens show only two cases in which such a change was evident. An increase in the relative length of a down-stroke is much more common, and, in general, an increase in difference in length is twice as frequent as a decrease in difference in length.

The mannerisms exhibited in dotting the i are very constant. This i-dot may be observed from three points of view; its localization, that is, the distance it is placed above the line and its position directly above or to the right or the left of the i; secondly, its form, which varies in an extraordinary number of ways from comma-shaped to wedge-shaped, not to mention its size; and, thirdly, the time of its making, immediately after the letter itself or after the word or line has been written. One would need to watch the penman while writing in order to establish this latter habit. In the disguises I collected, there are no obvious changes of localization in the placing of the dot, although in several specimens there is great variability in the natural hand itself. So far as form was concerned there are several deliberate attempts to vary the form. Bizarre forms were adopted for the dot, such as the use of a circle, or of a v-shaped figure. I am inclined to think that two or three of these changes were motivated by a knowledge on the part of the penman of the fact that the dot of an i is most characteristic.

Some of the changes just mentioned are deliberate, a revelation of what the subject believes to be characteristic of handwriting individuality. Of these deliberately sought shifts, some are easily manipulated, slant, for example, and change in absolute size. Others are handled with greater difficulty because of their dependence upon psycho-physical factors, as, for instance, degree of connection. Still other changes are dependent upon the general instruction to disguise the hand and are not directly willed by the subject nor even noticed by him.

Let us be more specific. Absolute size is easily changed voluntarily. But not all changes in size are to be attributed to direct volition. Increased attention to writing results in decrease in the size of writing and in increased pressure. The uniformity with which changes occurred in these directions is then, in part at least, an outcome of effort of attention and not wholly a product of intention. Increased size, on the other hand, may result from discontinuity of the motor impulse so that each letter is written as a separate unit rather than as part of a word. One would expect to find this increase in size in disguises in which attention is concentrated upon variation in the form of individual letters. Frequent breaks in connection between letters would also result from such a break-up of the motor impulse.

Alignment and the shape of the i-dot may be deliberately varied if one chance to know his own mannerisms and if he can hold his attention consistently to the detail in question. Details of form are very hard to change particularly in the middle and at the end of a word. The style of a capital is not hard to shift.

The results of this canvass of the methods utilized in disguise of hands agree very closely with what has been reported by Meyer as the outcome of his investigation and with the scheme adopted by the Berlin police in their indexing of handwriting specimens as part of their system of identification of criminals. In this latter system the characteristics of handwriting are arranged in a descending scale beginning with the elements that are most easily altered and ending with those that are least subject to change.

A further point of interest is a comparison of these shifts that accompany an effort to disguise the hand, with concentration of attention upon the act of writing, with those that are the outcome of distraction of attention from writing and, in some instances, of completely automatic writing. The shift in size that is significant of automatic writing has been somewhat thoroughly discussed in another connection.[8] Increase in size is a general outcome of increased automatism, just as decrease in size is an effect of concentration of attention upon writing, unless the latter result in a complete dissociation of letters and separate impulse for each. A decrease in pressure is also an outcome of automatic writing but less evidently so than the increase in size. Completely automatic writing results apparently in script that is more continuous than the usual writing but in case of incomplete distraction there would be alternate fixation and release of attention with, probably, increased discontinuity. Changes in slant do not occur in automatic writing as they do in disguised hands, although there seems to be in some cases a tendency to greater verticality. Changes in form are in the direction of disorganized or childlike hands.

Between the two extremes of voluntarily disguised writing and writing produced without conscious supervision lies the ordinary writing with which graphology deals. It is evident where one should look for lapse of control. In ordinary writing such control is greatest at the beginning of words and at the opening of a manuscript. Conventional restraint becomes progressively difficult as speed of writing increases. With deepening interest in content, writing becomes freer and bolder. Every prolonged piece of writing shows the shift from conscious to involuntary control, and in this fact the graphologist finds an opportunity for observation of certain characteristics of the motor impulse.

Let us turn now to the second question, the success of a disguise as determined by the failure of the judges in penetration of the disguise.

But before entering upon the question of the success of the individual penmen, a word concerning the varying skill of the sixteen judges. The range in success runs from only one correct identification of the twenty-four disguised hands to an accurate pairing of eleven specimens (a record made by a bank cashier). The average number of correct identifications (and the median record) is six, or twenty-five percent.

About half of the judges were taken from the college community which produced the disguised hands, and, in some cases, they recognized a number of the natural hands. This familiarity with the natural hand increased slightly the number of correct identifications. There exists, however, a very great individual difference in the ease with which handwriting is recognized even when undisguised and in the facility with which handwriting specimens by the same penman may be paired. For ten of my judges in this test I have record of their success in the matching of undisguised hands. The group is too small to be of much value but the results of the two tests give a coefficient of correlation of .41 (P. E. .18).

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[8] "Control Processes in Modified Handwriting." *Psy. Rev. Mon. Sup.*, 1908, 37, p. 122f.

The outcome of this aspect of the experiment justifies the distrust on the part of the most careful handwriting experts of the opinion of the ordinary observer as to the genuineness of a given hand. The chance of error is so great that the judgment of the amateur can have little weight, although, obviously, the opinion of one may be worth more than that of another,—a matter which could be determined only by a controlled test. Certainly the confidence with which a witness —or a reagent in the psychological experiment—expresses his opinion bears little relation to his value as an observer and might be most misleading in a trial in court.

Such strictures against handwriting—identification on the part of the amateur only serve to point the value of the work of the expert, with his instruments of precision, his microscope, his enlarged photographs, his multiplication of observations, and his knowledge of where to look for significant variation.

Three of the judges who took part in the test on disguised handwriting were given a second trial at matching after an explanation had been given them concerning the significant and non-significant features of writing individuality. They were advised to ignore changes in size, slant, and form of capitals. Their increased success was as follows: (A) from nine to twelve correct identifications; (B) from six to nine; (C) from five to eight.

So far as the individual disguises are concerned, some were much more effective than others. Three could scarcely be called disguised since they were correctly paired by almost every judge. Of the other twenty-one, four were so well disguised, as to wholly elude capture; eight were identified by only one or two judges each. The remaining nine were correctly paired by from three to seven of the judges.

The three who fail completely at disguise write very individual hands. Their failure was evident to themselves and they made subsequent attempts to mask their writing without much greater success. Of the four completely successful disguises, one is a semi-print style, another is a most clever imitation of a friend's hand included among the specimens, with which it is matched by four different judges. Two others show very great shifts in slant and size, changes which however easily manipulated seem quite effective in deceiving the ordinary observer. The more conventional and immature hands that approximate a given system cause considerable difficulty in the test.

Calculating the percentage of actual identifications, on the basis of the possible number, for the groups of older and younger subjects respectively (twelve each), we find it 34 percent for the older group and 18.3 percent for the younger. The three reagents who failed completely to disguise their hands all belong to the older groups. Dropping these out and recalculating on the basis of actual to possible identifications we find the percentage of successful identification for the older group is 17.4 and for the younger 18.3 percent.

Calculating the percentage in the same way, but with a division on the sex basis (twelve each), we find the percentage of correct identifications is 22.5 in the case of the women and 30 percent for the men. Again dropping out the three subjects who failed so signally at disguise (two women and one man) and recalculating, the percentages run 10.3 percent for women and 24.7 percent for the men. Our numbers are too small and too greatly affected by individual records to be of great value but so far as they go they indicate that women are more successful in disguise than men, and the younger penmen more successful than the older. All of the four subjects whose disguises were not penetrated were women (one from the older group, three from the younger). Of the eight specimens recognized by only one or two judges, four were written by men (three of the older, one of the younger group) and four by women (three younger group, one of the older). The best records, so far as disguises are concerned, are made by the young women.

The success of the younger group, particularly those writing an immature hand, is not necessarily due to the assumption of another graphic individuality. A return to the conventional system would cause a confusion of such a specimen with others similarly motivated. In a personal letter in which he comments upon the specimens used in the present test Mr. Osborn writes me: "Writing by those who have not long been doing writing outside of school is bound to be similar in many ways and when such writing is disguised its individual features may be modified and its general features remain, which would tend to connect specimens written by different writers." Yet this is not the whole story. In a few disguised specimens there is, very evidently, the assumption of a distinct, yet different, individuality. The most interesting disguises are those in which there occur such curious changes in style. Some of these disguises come from the older group and lead to the conclusion that an effective disguise is much more a matter of the individual constitution than of age or even sex.

It has been held that ability to shift handwriting individuality is akin to ability in acting. But we have as yet no analysis of what traits characterize the dramatic type. Holt[4] suggests that "The actor's is merely the excessively mercurial and labile character." From my knowledge of my subjects I should say that those showing much facility in the adoption of another chirographic individuality, were, in the main, much more adaptable, more pliable, than the others. There is, however, one rather striking exception to this statement. This reagent—a girl of the younger group—is very visual in type and talented in drawing and fine handicraft. She took pleasure in producing for me an amazing variety of hands. Personally, she is of a distinct and somewhat inflexible individuality who yields slowly to social pressure. She is artistic, rather than imaginative.

Four of the subjects in this test were also reagents in my experiments on control processes in handwriting (R, B, S and D). For these I have a fairly complete analysis of their general procedure in writing. Of the four, two (R and B) were highly successful in their disguise and two (S and D) very inapt. D (the writer of this paper) was particularly poor and that in spite of the fact that she was probably more aware than any other person who attempted the disguise of the tell-tale points in chirography.

It is certainly significant that the alignment of these subjects in the test on handwriting disguise tallies with that found in the earlier experiment. R and B belong to the so-called "motor" group; D and S to the "sensory."[5] Characteristic of the first group was the high degree to which writing was turned over to automatic control; characteristic of the second, was the maintenance of conscious writing control, usually accompanied by a vivid sense of kinaesthetic sensation. For the first two the act of writing is successfully organized and the motor impulse smooth and effective. For the latter there is consciousness of muscular effort in writing and evidence of motor inhibition.

Interpreted on a conventional habit-basis one might perhaps expect the first two subjects to be less expert than the other two in disguise of hand. But undoubtedly our conventional views of habit need reconstruction especially along the line of ease in habit-breaking and the relation of this to the mental organization and constitution as a whole. Very possibly the cue to the interpretation must be sought in the smoothness, effectiveness and lack of conflict in the motor impulses themselves, which would facilitate both habit-formation and quick readjustments.

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[4] "The Freudian Wish," 1916, p. 35.

[5] *Loc. cit.*, p. 140f.

A dramatic reaction to the instruction to disguise one's hand, in which one initiates and then yields confidently to a graphomotor pattern somewhat different from his habitual one, is more effective in disguise than is an effortful disintegration of graphic details, with a constant effort at inhibition of habit. That both kinds of disguise may be successfully achieved is, however, evident. Psychologically and practically they are of differing interest. The effortful disguise although it may conceal its source effectively will give evidence of not being a natural hand by inconsistencies, by retouching, and by the presence of fantastic forms. This type of disguise is, possibly, that most often found in the anonymous letter. The dramatic disguise will be less evidently a disguise and in its most successful forms points to an interesting mental type. It occurs in certain forms of forgery.

Meanwhile we note that Klages cites versatility in the shift of hands as characteristic of the fluidic personality. Graphic virtuosity is evidence of histrionic ability or of the split personality of the hysteric. The subject is worth investigation both in connection with a study of one type of criminal—the forger —and investigation of the hysteric and of the double personality. Several possibilities of application suggest themselves in connection with the study of the handwriting of the normal person.

THE ATTITUDE AND THE REACTION OF THE BUSINESS MAN TO PSYCHOLOGY

According to the plans announced in our previous number (p. 175) we intend to publish under the above heading from time to time communications from the business world concerning the problems that are met and the methods that are used in regard to the human element in business. We have recently received a long and instructive statement from the Employment Department of the National Cash Register Company, from which the following items are abstracted because of their general significance.

Methods of Improving Human Efficiency.

Coincident with a cry for greater efficiency there has developed an ever increasing demand for trained workers, because it is generally recognized that efficiency in its last analysis depends on the man on the job. Developing the system and equipment of a business is comparatively easy. Developing the human side is a task filled with tremendous obstacles. Many large business-concerns are constantly striving to create their own supply of competent workers, which efforts in many cases call for the instruction of the entire force, from the messenger boy to the head of the firm.

The various methods of improving the human efficiency in the present concern involve such educational forces as an employees' reading room equipped with professional and recreational literature, a publication department from which instructive bulletins, leaflets, and pamphlets are issued to the employees at home and "on the road," and an auditorium for demonstrations and lectures, the latter frequently illustrated by lantern slides or moving pictures — on topics related to the industrial and business activities of the firm. Another, somewhat less direct method of educating the employees to higher efficiency is a chain of mottoes framed and suspended in the corridors and workrooms. These mottoes express the greatest thoughts of the greatest men the world has known. Sometimes these mottoes are printed on the pay-envelopes or inserted in the correspondence from the firm to its employees.

One of the great educational forces are the corporation and continuation schools which offer regular class-room instruction in the various business activities, such as typewriting, stenography, business correspondence, commercial mathematics, industrial engineering, and salesmanship. One of the first, if not the first, corporation school in salesmanship was established in 1894, and it is attended regularly by experienced as well as by prospective salesmen. In 1915 a school was held in which newly graduated college men were the pupils. The course covers usually five weeks and three sessions are held each year. There is a regular outlined course of study with written examinations, after the conclusion of which the men are assigned to different districts where they continue to work for some time under close supervision. On different occasions groups of men return to the factory for additional training in order to familiarize them with the industrial processes of production. Department heads and senior clerks are encouraged to attend for four hours the Alexander Hamilton Institute Courses in business administration, finance, and accounting. Now and then groups of employees are sent on excursions to important industrial and commercial exhibitions, or to salesmen's conventions, or other professional congresses, the firm bearing the larger share of the travelling expenses.

There is also a school for apprentices in the metal trades, which in the near future is to be extended to include three other trades represented in the plant. To this school about forty boys are admitted each fall who have completed at least two years of high-school work. They are first required to stand a test to prove their fitness and given temporary employment during the vacation period between the ending of the second high-school year and the opening of the trade school. This temporary employment is used as a further test of a boy's fitness. *The boys who are accepted for apprenticeship work one week and go* to school one week alternately. The school is in session five days per week, seven hours per day, for twenty-four weeks, and each boy is indentured for four years. On Saturday morning of each school week the boys report at the factory for special instruction, in order to correlate the school work with the factory work. A special course of studies, giving the boys third and fourth year high-school work, has been arranged, for the satisfactory completion of which full high-school credits may be allowed, so that these boys may receive the regular high-school diploma. After graduation from this high-school two routes are open to the boys. They may continue as apprentices until the expiration of the four years, or until, in the opinion of their supervisors, they have become proficient tradesmen. Those who follow this course will attend a continuation school at least two half days per week. Those who elect the other course now enter the College of Engineering at the University of Cincinnati, remaining there for five years, spending alternately two weeks in college and two weeks in the factory. Both, apprentices and collegiate students are paid for the time spent in the factory.

There are several other more subtle ways by which the efficiency of the human element is being improved but which do not readily lend themselves to description. The requisites of success as summarized by Mr. John H. Patterson are: health, honesty, ability, industry and knowledge of business.

A NOTE ON THE GERMAN RECRUITING SYSTEM

The recruiting system of Germany during peacetimes is based upon a complete and thoroughly systematized index for every youth of military age. This index is obtained in the following way:

Every spring, usually in April, military registration-days are held in all the larger communities of the empire, on which the youths who have passed their seventeenth birthday are obliged to appear at the military registration offices for a thorough examination. When a boy appears there for the first time, he is given a complete physical examination as well as certain sensory tests of vision, hearing, etc. He must also state accurately his occupation, previous school training, family conditions, plans for the immediate future, and furnish other information required of him by the examiners, who are regular officers of the army, army-physicians, and army-clerks.

If the boy seems acceptable, he is required to return for a final examination during the following June, when his previous records are checked up and when he is finally assigned to a certain army-branch. If the boy is not acceptable,—and the great majority usually are not taken in their first year,—he is merely told to return for the second time a year later. At that time he is again fully examined and his previous records are corrected as far as that is necessary. If he is accepted this time, he has to appear for a final rating in the following June, when he is assigned to a certain branch. But many are set back for a third year, when the whole method is repeated as in the preceding years. Whether he is finally accepted or not, he must appear in June for a last re-examination, at which the former decision may be either confirmed or reversed.

The actual entry into the army for service does not begin until the following fall, after the great fall-maneuvers, which are held annually in various parts of the empire. The procedure described above holds true for all boys who have had only a public school education. Those who have completed the *realschule* or who are still attending higher schools may postpone their military service until they have completed their full course of education, including even their university courses. In addition, they also have the privilege of entering the army as "one-year volunteers," which means that instead of the regular two years service in the infantry or cavalry or minor branches (excepting artillery) they may reduce their military service to one year, provided that during this time they support themselves completely and furnish their own military outfits. From their ranks may be drawn the officers of the army, both active and reserve-officers, since their higher education is accepted as a partial preparation for military training.

From this description it appears that by far not all German youths have to serve in the army; only the physically and mentally best fit are required to serve Those falling below certain standards, or being the sole dependents of their family, are thus exempted. For several years after the military service has been concluded, the young men are required to drill annually for several weeks, usually in the fall, in connection with the fall maneuvers. These men constitute what is in peace-times called the "reserves."

As to the selection of each recruit for a given branch of the army, little is known to outsiders, but certain obvious principles are employed in the selection. For example, the man's occupation is of deciding influence in many cases; farmers' sons are preferred for cavalry and artillery service; the boys along the seacoasts are put into the navy, wherever possible; those who have handled machinery are preferred for the engineering corps or the aviators, etc., which branch includes also many miners. Other requirements are made for men who are selected for the ambulance corps. In peace-times at least these selections are very carefully made, since the recruiting stations have all details of a certain man in well catalogued form, and there is the most systematic cooperation between the various stations, so that a man from one particular part of the country may be assigned to a very distant training camp, because it happens to be short of the kind of men that are wanted for a certain purpose. Of course, there are all kinds of exceptions made to the rule that a man must go to whatever place or branch he is assigned, if good reasons can be given for requesting such an exception.

The office force which is required to keep this vast organization in good functional order is provided entirely by men serving their military terms either as officers or as regulars. If a boy volunteers to spend twelve years in the army, he is (provided he can advance during his first two years of service to a position of non-commissioned officers) given every encouragement to specialize along some particular line, either as a trainer of recruits, or as clerk in some office, or as assistant to higher officers, and the like. At the end of the twelve years, the government provides for him a subaltern position in civil service, and when he gets too old for that he receives a pension. Should he die early, his wife receives a government pension to her death. In this way all the men for the government service in the postal and telegraph as well as in the railroad systems are provided, and frequently the men are given police positions in the larger cities. In this way the government trains and constantly prepares a supply of efficient and loyal men for its various branches, and even in private life a man with a good military record will receive preference by any employer over a man who has not had military training.

BOOK REVIEWS

Hugo Münsterberg. *The Photoplay, A Psychological Study.* D. Appleton and Company, New York, 1916, pp. 233.

This book is chronologically perhaps the last one of the author's long list of publications, and as such it throws a new and strong light on his theory of values, in particular aesthetic values.

The two chapters of the Introduction deal with the outer and inner development of the moving picture plays. In the first chapter the author shows the historical development of the mechanical devices used in kinematographic machinery, while the second chapter briefly points out the changes in complexity of the picture exhibited, from such a simple view as that of a galloping horse to dramatic performances lasting sometimes several hours. This constantly increasing complexity has, according to our author, been responsible for the birth of a new art, and consequently he tries to prove that the modern photoplay is no longer a cheap substitute for the real drama or a photographic reproduction of theatrical performances. He says: "The art of the photoplay has developed so many new features of its own, features which have not even any similarity to the technique of the stage that the question arises: is it not really a new art which long since left behind the mere film reproduction of the theater and which ought to be acknowledged in its own esthetic independence?"

In order to answer this question the author discusses in the first main part of the book,—entitled the Psychology of the Photoplay and comprising chapters three to six,—the mental means by which the moving pictures impress us and appeal to us, while in the second part,—entitled the Esthetics of the Photoplay and including the remaining five chapters,—he examines first the general aim or purpose which underlies all artistic creation and the general conditions or means of the various arts, and then applies these general principles to a discussion of the means, demands, and functions of the photoplay.

Among the mental means he treats first the induction of illusory perceptions of depth and movement which are due entirely to a peculiar synthetising activity of the spectator's mind and conflict with his true perceptions of the artificial character of the observed scenes. Another mental means largely employed in the photoplay is attention, whose fluctuating, narrowing, and vivifying character is cleverly utilised, redirected, and enhanced by quick shifts of scenery, by emphasis of the pictorial foreground or a sharpening of outlines, and by the "close-up," thereby inducing at will all degrees of mental emphasis. Memory and imagination are likewise utilized, in as much as the order of the pictures is changeable, for they may be reversed, or later events may be anticipated, or interruptions may be introduced by "cut-backs" and the like. The use of the emotions is also very varied. The expressions of the emotions may be modified at will by actors as well as by the camera, in order to produce desired responses in the spectator, and the whole surroundings can be controlled and modified so as to heighten the emotional effect. Here, our author thinks, the photoplay artists, writers of scenarios, actors, and stage-directors, have not yet begun to realize the many psychological possibilities and advantages which their art has over all other arts.

In discussing the esthetics of the photoplay, Münsterberg maintains that true art never imitates nature, but it isolates its objects so that they not only arouse desires and impulses to action, but also satisfy them and thereby please and rest the onlooker. This is accomplished with material characteristically different from the means employed by nature, and therefore the photoplay should not try to approach to nature by removing the lack of color and sound. Its true nature is summarised by the author thus: "The photoplay tells us the human story by overcoming the forms of the outer world, namely, space, time, and causality and by adjusting the events to the forms of the inner world, namely, attention, memory, imagination, and emotion." Nevertheless it is subject to certain laws of esthetics, namely, those of unity of action and unity of characters. Its material may be taken from all natural sources, but it should not be borrowed from other artistic products. The function of the photoplay is as manifold as that of the other arts, but its peculiar charm lies in the fact that it projects or objectifies the mind's own operations in a way not possible to any other art, and therefore it deserves esthetic emancipation and independence.

Although by necessity argumentative in character, the author's style is vivid, forceful and pleasing. The analogies and illustrations are chosen with peculiar aptness, revealing a deep knowledge of the subject and adding greatly to the convincing force of the presentation. There is a suggestion of pioneer rawness in the treatment which, however, is softened by another pioneer characteristic, the vision of distant horizons and higher ideals. L. R. G.

MÜNSTERBERG, H. *Business Psychology.* Chicago, LaSalle Extension University, 1917. pp. XI and 296.

This book is a good presentation of psychology and its results as applied to industry and commerce. It begins by showing the place of psychology in every walk of life, and the place it must hold in business. It lays emphasis on scientific psychology as distinguished from the notions of the soul, so current in popular literature. In business it is what a man thinks, feels and does that is of importance, and this we can find out by studying his mental processes as expressed in bodily movements.

The Second Part of the book deals with "knowledge" and contains discussions on sensations and memory-ideas. A sensation never appears pure. It is always mixed with other sensations either of the same kind or of different kinds. Perceptions of space, time, form, the feeling of awareness and illusions are also discussed. Impressions remain the same in memory as in actual life; a color does not become dull, a sound not weak; there may, however, be a change of vividness. "All our remembering is a renewing of those brain processes which at first are started from our sense organs." But "the individual differences in the ability to renew earlier impressions are very great," and "these differences are of thousand-fold importance in the business world." It is of importance to know how a person learns and remembers in order to make him efficient.

The Third Part is called "Interest" and deals with attention, and feelings and emotions. In the great mass of reality that surrounds us we single out certain facts. "The great means of the mind for this end is the mechanism of attention." "The safest way and the most effective (of securing attention) is that which makes use of the existing dispositions for actions." It "needs frequent changes in order to stir up ever new reactions." Fatigue affects it; after three or four hours of work it is greatly diminished. The so-called monotony of the work is not so dangerous to attention as the shifting over from one work to another. This wears out the "mental energies" more in making the necessary adjustment. The application of the principles of attention to the problem of selling is important, and the possibilities here great. But since so much depends upon the feelings and the emotions it is necessary to take these into consideration. As the individuals differ it is necessary at first to call forth only a general feeling of pleasantness. A well-proportioned arrangement, charming colors, appeal to the humor, gracefulness and politeness bring the purchaser-to-be into a comfortable mood, and the first point is gained.

Part Four—Activities—deals with impulse and will, suggestion, the acquirement of abilities, the outer and the inner conditions of efficiency. Our so-called will-power is nothing but the tendency of our impressions, perceptions, or ideas to transform themselves into action. A physical act is not at the end when mind takes hold of it; it is inhibited or acted out in an automatic way. The question then is to supply stimuli that call forth the reaction wanted. This might be done by suggestion, which can suppress more or less completely any idea that opposes the action desired. The removal of the opposing idea may take place in one of three ways, or in all three: by re-enforcing the suggested idea, by undermining the opposing idea or by heightening the suggestibility of the subject. This can be done only by experience and by observing one's own former mistakes.

Both outer and inner conditions effect productivity to a great extent. It seems trivial that such a small matter as a quarter of an inch on the length of a sewing needle or one inch on the height of a chair should make any difference in the amount of a day's work, and still it does. An overfatigued, an intoxicated, or an emotionally upset mind produces unsatisfactory results.

Part Five—Individual Differences—deals with the problem of finding the right man for the right position. This becomes important, if we consider "that in a well-known steel mill 26,000 workers pass annually through the institution in order to maintain an average working force of 8,000." For this reason vocational bureaus have been established with good results. Psychology is now ready to contribute something to the solution of the problem. The so-called group psychology and correlation psychology can be used to a certain extent. Graphology and phrenology must be discarded altogether. The Blackford plan falls short in many ways. Consequently "the well-selected mental test experiments constitute the only method by which the mental fitness of men for special work can be found out beforehand in a reliable way." In the meantime some practical tests may be performed on the sensation, perception, memory, association, attention, feelings, and reaction time. A man might improve himself, but he remains essentially of the type that he belongs to, and the sooner he recognizes that, the better it is for him and for society, which may have a place for that type to which he belongs.

The first half of the book deals with psychology and the second half with its application to industry and commerce. For the psychologist there is nothing new in the book, and while the author presents the problems fairly, nevertheless conveys the impression that they are simpler than they are in reality. It is a popular presentation of the subject.

KARL J. KARLSON.

GANTT, H. L. *Work, Wages, and Profits.* Second Edition Revised and Enlarged. The Engineering Magazine Company, New York, 1916. pp. 292 and index.

The author of this work is a well-known expert in factory management, at one time associated with the late F. W. Taylor, and for years connected with the Midvale Steel Company. His book is made up of chapters delivered as addresses at business schools or elsewhere and published separately, for the most part serially in *The Engineering Magazine.* The first edition appeared in 1910, the second in 1912. The present issue is a revision and enlargement of the second. The increase of fifty per cent. in the size of the work has not resulted in a corresponding increase in the value, for the three new chapters either restate or illustrate the general principles.

Clear in statement and ample in particular instance, the book is the expression of optimism in industrial life where many have seen but a return to economic enslavement and personal degradation. This optimism is made to apply to both employer and employee; but the interest of the author is unquestionably that of the business man rather than of the workman. "The ratio of what can be done to what is done is even greater than three to one in work requiring skill and planning." Any suggestions that lead to so marked an increase in production are welcome, but the crying need of normal times is not greater production but a more equitable division of products, in short, higher wages.

Mr. Gantt is not so far out of harmony with his age, nevertheless, as to neglect the subject of higher wages. It is his belief, however, that greater production means higher wages. Accordingly, he devotes all his energies to a study of efficiency, not of machinery but of workmen. For the trade union he would substitute an efficient system of utilizing labor. The business man should employ such experts as Mr. Gantt to study the best methods of work. Laborers should be carefully supervised, gradually trained, and finally rewarded according to the labor performed.

Pay the best men well on a piece-work basis; the others you may leave on day work. Reward foremen for instructing the workers. Make all rewards permanent. Work according to carefully planned tasks and schedules.

"Buying labor is one of the most important operations in modern manufacturing." High wages mean, not greater well-being, higher culture or safer democracy, but lower cost and accordingly greater profits.

The assumptions regarding human nature apply more to the skilled than the unskilled worker. "A task has a psychological effect which is very striking." "Habits of industry are far more valuable than any kind of knowledge." Intelligent men are interested in learning. Earning a greater reward holds the interest and therefore lightens the task; but we may ask whether this holds good indefinitely. Learning to obey is bound up with close supervision. There is a general moral tonic that comes from the need of co-operation, for one man sees that if he does not do his share of a process his fellow-worker suffers.

To the educator, to the psychologist, to the student of civilization, this emphasis upon training in economic efficiency, comparable somewhat to the old apprenticeship and the modern technical school, is of absorbing interest. Alongside of education for citizenship we are to have education in the efficient production of material goods. Training men to work to advantage has been difficult and painful. Slavery, serfdom and the factory system have been landmarks in the process.

To the slave-driver, the lord's bailiff, and the efficiency expert have been given the unheroic but apparently necessary parts in the drama of taming man. The lazy, improvident and wasteful Adam has become No. 999 working under the stop-watch. N. S. B. GRAS.

JOSEPH A. MOSHER. *The Essentials of Public Speaking.* The MacMillan Company, New York, 1917. pp. xv and 207.

Professor Mosher's book aims to embody in clear and concise form the essentials of practical extempore speaking. It does not aspire to the rank of a work on oratory, but is confined to the more restricted area of practical address, calculated to minister to the requirements of the great body of students, teachers, lawyers, doctors, business men, and similar people who need to express their ideas clearly, forcefully, and practically. The author explains that the book is the outcome of his experience in helping men—students, business and professional men—to develop their ability to speak effectively.

This restriction of the scope of the volume constitutes both its merits and its limitations. The reviewer will hazard the guess that in its preparation Professor Mosher had chiefly in mind the needs of the busy professional man whose time and patience alike are more closely bounded than those of the college student. His problem accordingly turns out to be to compress into two hundred pages the guiding rules of extempore speaking, with explanation and illustration enough to make them carry over into the resulting work of the reader. Needless to say, this is no easy task; but one cannot avoid the feeling that at times brevity has overreached itself. For instance, on page sixteen we find the following discussion of the proper function of the conclusion.

"Rounding Out the Speech

"The speaker should aim in the conclusion to convey the impression of completeness, of having rounded out the address in a finished and satisfying manner.

"II. Clinching the Central Idea

"The conclusion also affords an opportunity for a final embodiment of the speaker's message in such concise and untrammeled form that his listeners will carry the essentials away with them.

"III. Arousing Enthusiasm and Exhorting to Action

"Finally, the speaker should try, whenever the nature of the subject warrants it, to arouse enthusiasm for the views set forth. Although ever mindful of the emotions of the audience, the speaker has aimed chiefly in the development to appeal to the mind, to convince. Now, having established the foundation of conviction, he is in a position to appeal more directly and intensely to the emotions. At this point is afforded, also the best opportunity to appeal for action in case such a response is desired."

This excerpt serves to illustrate an admirable feature of the book—its headings and sub-headings. There is seldom any doubt concerning what the author is doing from beginning to end, for his subject matter has been carefully classified and subdivided, and has been clearly summarized at the end of each chapter. The author may also be congratulated on his choice of illustrations. Although some of our old friends appear, notably Burke's Conciliation Speech and Lincoln's Gettysburg Address, fresh material and a new generation of speakers enliven many of the pages, for instance, President Wilson, Henry Van Dyke, Ex-Governor Hughes, Mr. John D. Rockefeller, Jr., speaking to the employees of the Colorado Iron and Fuel Company, and G. Lowes Dickinson on the League to Enforce Peace.

A teacher of public speaking who has been especially interested in argumentation (which indeed comprises most public speaking, and which is most often in the mind of the author in writing this book, will be inclined to regret that the student is left, in the discussion of the preparation of the speech, with only an outline, and is not furnished with even the essentials of a brief. An outline, such as printed on pages 94 and 95, tends too easily to suggest exactly that "inconsequential series of ideas" which Professor Mosher deplores on page 105. A brief is the most effective remedy for this very common fault in public speaking.

The reading of the Essentials of Public Speaking emphasizes anew the part which the instructor plays in any course on oral address. No text-book has been, and it is safe to say, no text-book will be, written which will take the place of a careful and sympathetic instructor. But those who wish a brief account of the essentials of extempore speaking will not go astray if they consult Professor Mosher's volume.

L. D. WHITE.

WILLIAM STERN. *The Psychological Methods of Testing Intelligence.* Translated from the German by Guy Montrose Whipple. Warwick and York, Baltimore, 1914. pp. X and 160.

The author in the preface states the general purpose of the book. Intelligence testing is one of the most promising fields of applied psychology, using that term in the strictest sense. "For this reason I wanted to make this survey of it accessible to wider circles of readers outside the psychological profession, especially to teachers of normal and of backward children, to school administrative authorities, to school physicians, to specialists in nervous and in children's diseases, and to those engaged in child welfare work."

The author begins with the nature and problem of testing intelligence, dividing this section into a treatment of Intelligence and Intelligence Testing and Practical Problems of Intelligence Testing. He defines Intelligence as "A general capacity of an individual consciously to adjust his thinking to new requirements; it is general mental adaptability to new problems and conditions of life." The author gives a timely warning that psychological tests must not be overestimated, as "if they were complete and automatically operative measures of mind. At most they are the psychographic minimum that gives us a first orientation concerning individuals about whom nothing else is known, and they are of service to complement and to render comparable and objectively gradable other observations—psychological, pedagogical, medical—not to replace these."

He then discusses the single tests and series of tests, devoting a section to the inadequacy of the single test. The monograph is largely a treatment of the method of age—gradation (Binet-Simon method). The author compiles the results of many of the investigations in which the Binet-Simon method has been used and subjects it to criticism, offering suggestions for the improvement and reorganization of some of the tests. The last section of the book is devoted to the estimation and testing of finer gradations of intelligence (with the aid of the method of ranks). This section has a very practical bearing on school work. It should be said that the Bibliography is complete, considering the fact that the book was written in 1912.

Stern's monograph is a most valuable contribution to applied psychology, and Whipple's excellent translation of it should be very warmly received by all interested in mental testing.

University of Illinois. JOHN A. STEVENSON.

ELLSWORTH HUNTINGTON. *Civilization and Climate.* New Haven: Yale University Press, 1916, 2d edition, xii+333 pp.

In an investigation of the influence of climate upon civilization, Dr. Huntington brings forward evidence from various sources,—from his explorations in Turkestan, in Mexico, in Central America and elsewhere; from his statistical studies of the weekly output of factories and of the weekly grades obtained by students in the classroom; and in numerous instances he cites from the work of other investigators. This mass of evidence indicates that climate is an influential factor in determining what degree of civilzation shall obtain in a given region. Migration to a less stimulating climate leads to a decrease in mental and physical energy; and this in turn gives rise to a decreased resistance to disease, and to a lesser efficiency in overcoming difficulties and in adapting to new conditions. Even in a given region, physical strength and mental efficiency are found to vary with the climatic changes of the seasons.

In numerous instances, however, ruins of ancient cities show that at one time civilization flourished in regions where the climate is now so arid that life is difficult. The author meets this apparent objection to his general view by citing evidence to show that climates have changed with the lapse of time. He advances a 'pulsatory hypothesis' which holds that the past was in general more moist than the present and that alternations of moist and dry have recurred in great cycles. An examination of the annual growth of trees (as revealed in cross-sections of the Sequoia trees of California, some of which are more than three thousand years old) supports this hypothesis. There seems reason to believe, for instance, that the beginning of the Christian era was moist and that the seventh century was dry; and that at times when the climate of a given region was favorable, the inhabitants possessed a maximum of virile energy.

The author presents a number of maps showing the present distribution of civilization. These maps are based upon replies received from one hundred and thirty-seven geographers, anthropologists and others who had been asked to assign values to various geographical regions indicating their rank as contributors to civilization.

A chapter which is of special interest to readers of this Journal reports the results of a statistical investigation of weekly variations in the efficiency of factory operatives and of students. The operatives were selected from factories in Connecticut, Pennsylvania, Georgia and Florida. All of their tasks demanded speed and accuracy, but they included such diverse activities as the polishing and packing of hinges, the making of cigars, the assembling of parts of motors, etc.; and since it was all 'piece-work' one seems justified in inferring that the operatives worked at approximately maximum efficiency throughout. It was found that efficiency varies with the seasons, rising to a maximum in the spring and again in the fall; and sinking to a minimum at midsummer and again at midwinter. A survey of the weekly averages obtained by students at Annapolis and West Point shows a similar variation of mental efficiency with the seasons.

Dr. Huntington's book is a valuable contribution to the literature. The author displays a high degree of ingenuity and insight in the discussion of his problems; and he marshals his evidence in convincing fashion. The book should be read by every student of applied psychology.

Clark University. J. W. B.

SUMMARIES

Walter B. Swift. *A Psychological Analysis of Stuttering.* Journal of Abnormal Psychology, October-November, 1915. *Studies in Speech Disorder, No. 5, The Speech in Athetosis.* Review of Neurology and Psychiatry, April, 1916. *The Possibility of Voice Inheritance.* Review of Neurology and Psychiatry, March, 1916.

In the first article the author shows that a complete, automatic visualization process may be developed by vocal drill in cases where previously there was total absence of all these visualization processes during speech. In relation to the stuttering, the symptoms disappeared in proportion as the picturing processes developed. This may therefore be considered as the "new treatment indicated" in the article in the Journal of Abnormal Psychology. I next plan to present a long series of such cases so treated, presenting both the original absence of picturing and its final development. By that time I think I will be ready to give out my system of treatment in final form.

The second article shows that athetoid speech is a constant variation in vowel form and consonant sound, clear only when correctly struck during the constantly changing contractions, or when, during rare moments of relaxation, the sounds are hit before contractions occur.

In this paper I claim abundant evidence to show the possibility of voice inheritance. (1) Literature on eugenics and cacogenics shows that bone shapes are probably inherited. (2) The nose of the Indians, and the Greeks, and the Jews, prove this pretty conclusively. (3) The lower animals afford data that put this thesis beyond doubt. Thus it is proved that bone forms are inherited. Then what is contained in them is also inherited, and therefore the functions that those cavity shapes subserve, such as vocal quality and utterance, are likewise inherited.

W. B. Swift.

J. E. W. Wallin. *Criminal Irresponsibility.* Journal of Delinquency, Vol. 1, November, 1916.

The author shows that the misuse of the plea of moral irresponsibility on the basis of "temporary insanity" or "emotional insanity" or the like has started a reaction among legal and lay students of crime against the axiom of treating irresponsible criminals primarily as irresponsible and only secondarily as criminal. The difficulty has been rather enhanced by extending the meaning of such terms as feeblemindedness, criminal imbecility, insanity, and psychopathic constitution. The author states that "it has not yet been conclusively shown that alleged 'feeble-minded persons' with Binet mentalities of from X to XII are incapable of forming moral judgments, of understanding the qualities of right and wrong acts, and of choosing right acts and of avoiding wrong acts." He agrees with Tredgold's concept of feeblemindedness and believes that "in the end, we shall make greater and more permanent progress, if we err in the direction of conservatism, and if we suspend judgment on moot questions pending the accumulation of further experimental data."

L. R. G.

EDWARD K. STRONG, JR. *The Factors Affecting a Permanent Impression Developed Through Repetition. Journal of Experimental Psychology*, Vol. 1, August, 1916.

The experiments reported in this article were made with full, half, and quarter page advertisements arranged in four dummy magazines in such a way that each advertisement was seen four times. These four repetitions occurred in the first set of tests at the same sitting, in the second set, at intervals of one day, in the third set, at intervals of one week, and in the fourth set (previously reported in the March, 1914, *Psychological Review*), at intervals of one month. The same advertisements were then rearranged among a group of new advertisements, and four weeks after the first exposure (except in the case of the fourth set, when the second exposure occurred sixteen weeks afterwards), the same people were tested to determine how many of the first class of advertisements were recognised as having been seen repeatedly before. The problem was to find out the relative value of size, frequency, and time-interval for producing the most lasting effect on the reader's memory. The number of observers for the four sets of experiments varied between 18 and 25, totalling 38 men and 48 women.

Among the many significant results the following are pointed out as of special interest. The first presentation is more effective for large than for small advertisements, that is, the smaller profit more by repetition than the larger. The time-interval of a few minutes between repeated presentations has the greatest effect upon the full page, and the least effect upon the quarter page advertisement. The interval of one month is the least favorable regardless of size. With regard to size, the results of a previous investigation were confirmed which indicated that "the attention-value of space increases approximately as the square-root of the increase in area" and sometimes as much as 25 or 30% more. Another fact previously established was confirmed, namely, that "the same total amount of space is more effective when used in large amounts than when used in small amounts but more frequently." More important than size, repetition, and length of time-interval between repetitions is the factor of the number of advertisements seen at one time; the larger this number, the less permanent is the impression received from any one of them. L. R. G.

AGOSTINO GEMELLI. *The Application of Psychophysical Methods to the Examination of Candidates for Aviation-Service.* (With four illustrations, thirteen diagrams, and four tables). *Rivista di Psicologia*, August, 1917.

This research was carried on during 1916 in the Italian war-zone, under the auspices of the Minister of War, and reported at the Congress of the Society of Scientific Progress, April, 1917. The present article is mostly a description of the methods employed, with a few results given mostly as illustrations of what can be expected from the methods. The latter consist of two parts, the ascertainment of the psychical profile according to Rossolimo, and the graphic records of circulation, respiration, and blood-pressure taken before, during, and after flights. Rossolimo calls for the measurement of sensory, muscular, and mixed reaction-times to visual, tactual, and auditory stimuli, which were obtained both before and after flight. The latter show uniform retardations of from 6 to 45 sigma with frequently much smaller mean variations. The "emotional resistance" was tested by pneumographic and plethysmographic records while hearing stimulus-words referring to events connected with aviation, and especially to personal experiences of that kind. Other tests required by the Rossolimo profile were measures of concentration and range of attention, of the capacity to recognize accurately, to judge quickly, to reproduce well, and to perceive colors, and of general powers of observation. A maximal score of ten points may be obtained in each of these twelve items, and a curve of the actual scores obtained represents the "psychical profile." Five samples illustrate the ideal type, the partial, and the complete failure.

Especially interesting are the results of the changes in circulation, respiration, and blood-pressure during various stages of flying and at altitudes to well above three thousand meters, which are illustrated by eight diagrams. From these data the author draws the conclusion that candidates for aviation should be free from the slightest traces of irregularities, from symptoms of diathesis which predispose the individual to quick and sudden changes in circulation and respiration or which lower his "emotional resistance." Other results showed that even short flights to low altitudes result in marked mental exhaustions with all classes of aviators, the most experienced not excepted. This fact may account for many accidents which are otherwise unexplainable. The author places no faith in retrospective accounts by aviators of their personal experiences during flying, for several reasons. He is continuing his experiments and perfecting apparatus for giving more reliable records during flight. L. R. G.

The following books have been received:[1]

George Thomas White Patrick. *The Psychology of Relaxation.* Houghton Mifflin Company, Boston, 1916.

Mary E. Thompson. *Psychology and Pedagogy of Writing.* Warwick and York, Inc., Baltimore, 1911.

Meyer Bloomfield. *The Vocational Guidance of Youth.* Houghton Mifflin Company, Boston, 1911.

Irving R. Allen. *Personal Efficiency, Applied Salesmanship, and Sales Administration.* LaSalle Extension University, Chicago, 1915.

Harrington Emerson. *The Twelve Principles of Efficiency.* Fifth Edition. The Engineering Magazine Company, New York, 1917.

Herbert J. Hall and Mertice M. C. Buck. *The Work of Our Hands.* Moffat, Yard and Company, New York, 1915.

H. Addington Bruce. *The Riddle of Personality.* Moffat, Yard and Company, New York, 1915.

Henry Foster Adams. *Advertising and Its Mental Laws.* The MacMillan Company, New York, 1917.

Robert S. Carroll. *The Mastery of Nervousness Based upon Self-Reeducation.* The MacMillan Company, New York, 1917.

H. L. Hollingsworth and A. T. Poffenberger. *Applied Psychology.* D. Appleton and Company, New York, 1917.

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[1] Mention here does not preclude further comment.

NOTES

The following is a complete list of Appointees for Psychological Examining in the National Army reported October 1, 1917, by Professor Yerkes, Major in the Sanitary Corps and Chairman of the Psychology Committee of the National Research Council, Washington, D. C.:

(1) Staff of section of Psychology in Office of the Surgeon General, Washington: Major Robert M. Yerkes in charge of section, Lieut. Arthur S. Otis in charge of statistical work of section.

(2) Lieutenants Clarence S. Yoakum, Marion R. Trabue, Jos. W. Hayes and Wm. S. Foster to serve as Chief Psychological Examiners in Camps Lee, Taylor, Dix and Devens respectively.

(3) The following to serve as Psychological Examiners with rank of Lieutenant in Sanitary Corps:

In Camp Lee—George O. Ferguson, Jr., Walter S. Hunter and Edward S. Jones.

In Camp Taylor—Karl T. Waugh, Heber B. Cummings and Edgar A. Doll.

In camp Dix—Harold A. Richmond, Herschel T. Manuel and Carl C. Brigham.

In camp Devens—John E. Anderson, Horace B. English and John T. Metcalf.

(4) In addition to the above commissioned examiners the following men have been given civil appointment for psychological examining:

In Camp Lee—Leo T. Brueckner, Donald D. Paterson, A. S. Edwards, Rudolph Pintner, Benjamin F. Pittenger and Ben D. Wood.

In Camp Taylor—James W. Bridges, J. Crosby Chapman, John K. Norton, Eugene C. Rowe, J. David Houser and C. P. Stone.

In Camp Dix—Thomas H. Haines, Norbert J. Melville, H. P. Shumway, Thomas M. Stokes, John J. B. Morgan and C. C. Stech.

In Camp Devens—Raymond H. Wheeler, Harold C. Bingham, Carl R. Brown, Chester E. Kellogg, Ralph S. Roberts, and Charles H. Toll.

Summary Report from Psychology Committee of the National Research Council for the Director of the Council of National Defense.

During the past month the activities of the Psychology Committee have greatly increased, both in variety and extent. The following list includes the most noteworthy lines of work:

(a) Perfecting of methods and plans for the Psychological Examining of enlisted men in four National Army Cantonments. In each cantonment a staff of ten psychologists, assisted by fifty or more enlisted men detailed from the ranks, will, during October and November, systematically examine the thirty to forty thousand enlisted men in the camp. It is believed that the Psychological Examining will result in the elimination of from one to two per cent of men who by reason of mental defect are unfit for military service; that in the second place it will supply company commanders with invaluable information concerning the intellectual ability and probable serviceableness of their men.

(b) As a development from the work of the Psychology Committee, a Committee on Classification of Personnel has been organized in the

War Department. This consists of a number of scientific men chiefly psychologists and employment experts, working in coöperation with representatives of the various bureaus of the War Department.

To this committee various problems of personnel have already been referred by the Department.

In each National Army Cantonment, a personnel officer, with the rank of captain, has been appointed and supplied with suitable facilities for securing information concerning the occupational training and experience of every man. This information is obtained immediately on report of the man to the camp. The personal record cards are filed in the central office at or near Division Headquarters and are already being systematically used by Division Staff officers in the assignment of men for special kinds of service. Everything indicates that this systematic handling of the vocational problem in connection with military service will result in greatly increased efficiency and personal satisfaction to enlisted men.

The Committee has also undertaken to assist the Signal Corps in the organization of examining boards and methods for the selection of men to be commissioned in aviation service. Several psychologists have already been recommended for commissions as captains in the Signal Corps to aid in this way.

Certain members of the Committee are coöperating with the Quartermaster Department in the development of plans for the classification and assignment of men from the Officers' Training Camp of the Quartermaster Corps.

The work initiated by Dr. Scott in the first series of Officers' Training Camps has been ordered continued and extended to all of the second series of camps. It involves the use of personal record sheets which supply ratings of individuals on the basis on which selection for commissions may be made.

(c) Work initiated by Dr. Dodge of the Psychology Committee, directed toward the development of methods of selecting men for various kinds of naval service, has continued and been extended in various directions. One group of "Dodge Methods" of measurement has recently been ordered to use on the main fleet.

There are various other subsidiary lines of psychological service more or less directly related to military activities. In general it may be said that from the organization and early work of the Psychology Committee of the National Research Council have already developed many more lines of fruitful and apparently immediate serviceable endeavor than the members of the committee dreamt of.

Respectfully submitted,

Robert M. Yerkes,

Major Sanitary Corps, Chairman Psychology Committee
National Research Council.

Ed.—As a supplement to the report given above we hope to print in our next issue detailed statements about the work of the various subcommittees mentioned under (b) and (c), especially of the Personnel Committee represented by Professor Bingham, of the work in connection with naval service, by Professor Dodge, and with aviational service, by Professor Watson.

Doctors Arthur S. Otis and Truman L. Kelley have been appointed members of the psychological staff in the Office of the Surgeon General with special responsibility for statistical work and the revision of methods of examining.

The Committee on Classification of Personnel in the Army has been appointed by Secretary Baker and placed under the jurisdiction of the

Adjutant General. This Committee has organized and is directing the occupational census and classification of the men in the National Army; has installed in the second series of Reserve Officers' Training Camps the system of personal records and ratings by which the men will be selected for commission; has coöperated with the Signal Corps, the Quartermastsr Corps and other arms of the service in preparing application forms, qualification records, and other aids in sifting and assigning personnel; and has stimulated research on qualifications desired in aviators and on tests for selecting recruits to be trained for special duties. On the scientific staff of the Committee are the following psychologists: Walter Dill Scott, Director; E. L. Thorndike, Chairman; W. V. Bingham, Executive Secretary; James R. Angell, R. Dodge, R. B. Perry, J. F. Shepard, E. K. Strong, Jr., J. B. Watson, R. M. Yerkes, L. M. Terman. Dr. Terman gives up his work with the Committee to return to Stanford University October 1. Dean Angell has leave of absence from the University of Chicago and will be in Washington until January 1. The other members of the Committee are all giving part or full time to the work in Washington. They have the coöperation of R. C. Clothier, H. L. Gardner and sixteen other employment managers, of several army officers, and of a few volunteer assistants.

The Bureau of Education at Washington has recently issued a Bulletin, 1917, No. 9, on *Department-Store Education, an Account of the Training Methods Developed at the Boston School of Salesmanship under the Direction of Lucinda Wyman Prince*, by Helen Rich Norton, Associate Director, School of Salesmanship, Women's Educational and Industrial Union, Boston, Mass., from which the following extracts may prove of general interest to the readers of this JOURNAL:

The purpose of the Boston School of Salesmanship is fourfold: (1) "to make advancement in the profession of selling depend on efficiency and not on years of service," (2) "to increase the pupil's (intellectual) power and judgment," (3) "to discover whether or not a girl is fitted for the vocation of selling," and (4) "to give the girls worthy standards of all kinds." The course of study includes the subjects of salesmanship, textiles, general merchandise, hygiene and physical education, arithmetic, store system, English, color, and design. In 1909 a class for teachers of salesmanship was inaugurated which in 1913 became affiliated with Simmons College. The members of this class devote their mornings to the observation of the methods of teaching, practice teaching, individual coaching and a conference with the director. The afternoon sessions are devoted to the study of applied psychology, education, textiles, and economics or welfare work from an economic standpoint.

The course in applied psychology consists of the following work: "Ordinary business situations are examined in order to analyze out of them some of their psychological principles. The work involves a review of the fundamental principles of psychology, an application of these principles to various department store methods, and a study of the increased efficiency in department store transactions that may be developed through the conscious application of psychological principles."

The success of the whole undertaking was so remarkable that Mrs. Prince, the director of the school, was asked to introduce the teaching of salesmanship in some of the Boston high-schools. In 1916 ten high-schools offered such a course which was attended by about 800 girls. In a similar manner courses of salesmanship have been introduced in the evening classes of the continuation schools.

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